FEBRUARY, 1937

Railway Engineering and Maintenance

The big

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DOUBLE HIPOWER

Thackeray Spring Washer

al Rib Washer

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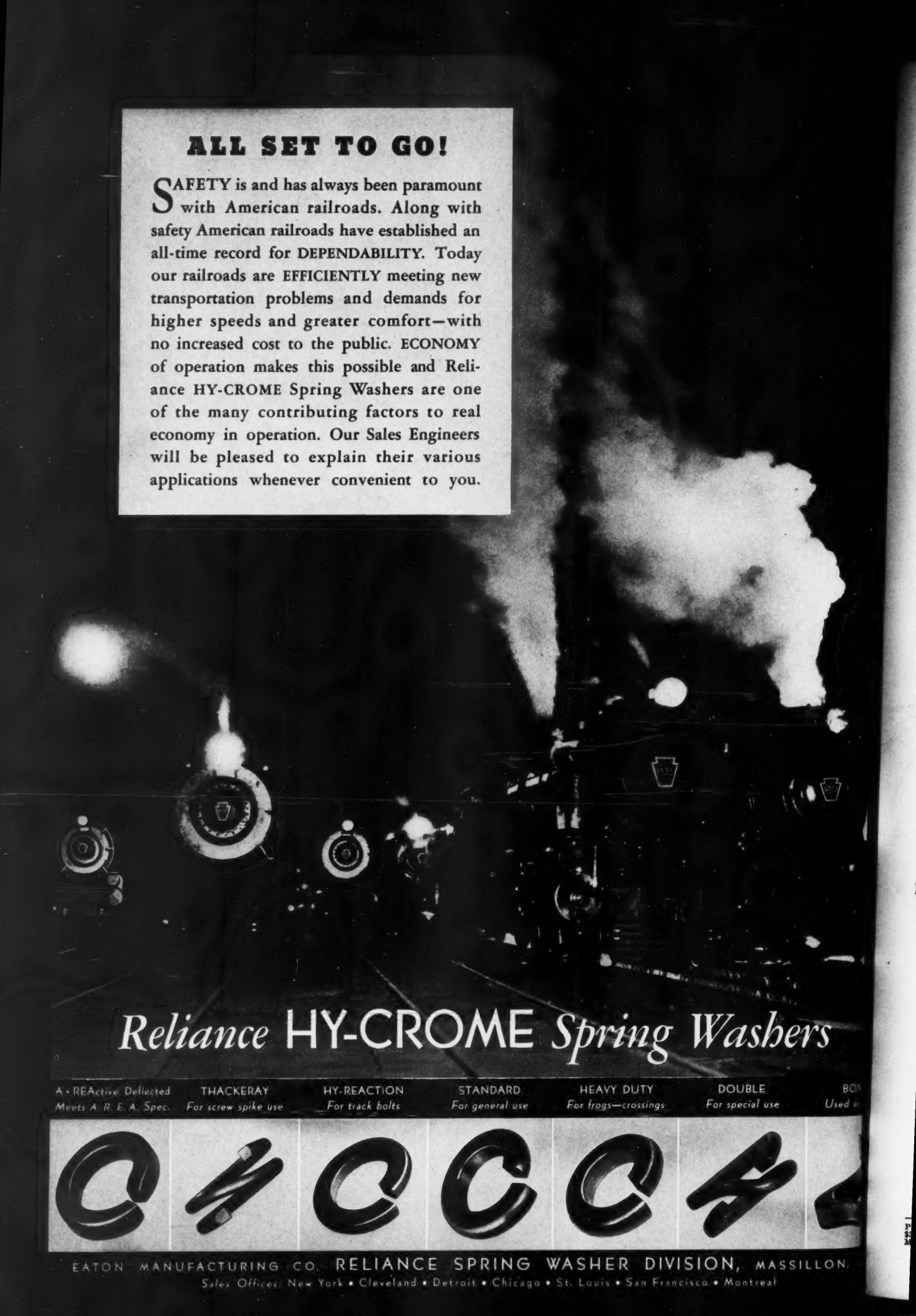
ANKOR HIPOWER

That meet every Railway need!

NATIONAL LOCK WASHER COMPANY, NEWARK, N. J.



ALL SET TO GO!

SAFETY is and has always been paramount with American railroads. Along with safety American railroads have established an all-time record for DEPENDABILITY. Today our railroads are EFFICIENTLY meeting new transportation problems and demands for higher speeds and greater comfort—with no increased cost to the public. ECONOMY of operation makes this possible and Reliance HY-CROME Spring Washers are one of the many contributing factors to real economy in operation. Our Sales Engineers will be pleased to explain their various applications whenever convenient to you.

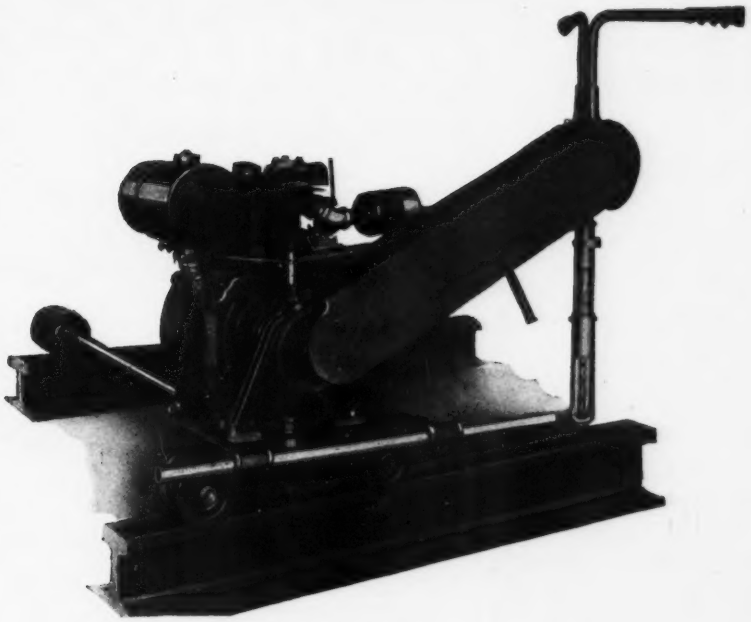
Reliance HY-CROME *Spring Washers*

A·REActive Deflected	THACKERAY	HY-REACTION	STANDARD	HEAVY DUTY	DOUBLE	BON
Meets A. R. E. A. Spec.	*For screw spike use*	*For track bolts*	*For general use*	*For frogs—crossings*	*For special use*	*Used*

EATON MANUFACTURING CO. RELIANCE SPRING WASHER DIVISION, MASSILLON

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

Raco Tie Boring Machine



Bores ties more than twice as fast as any other accepted means . . . Bores holes absolutely vertical . . . Locates all holes exactly in center of tie plate punching . . . Automatically controls depth of hole . . . Chips are blown away from hole as fast as made, leaving hole clear . . . One-man operation . . . Operator works in an erect position . . . The machine pushes or pulls along track with a pressure of five pounds . . . It can be removed from track by one man.

For Screw Spiking use Raco Tie Borer in conjunction with Raco Power Track Machine equipped with Screw Spike Chuck Unit. This combination of light, mobile units affords the most rapid, accurate and economical means of boring for and setting Screw Spikes to a uniform holding tension.

Boring holes for Cut Spikes has these decided advantages over old inaccurate methods of driving:

Greater holding power . . . Wood fibre undisturbed . . . Tie splitting eliminated, therefore retarding decay . . . Spikes always centered and vertical . . . No thrust against plates to ultimately cause spreading or pinching of track gauge . . . Fast and easy driving . . . Application of creosote to spike holes and minimizing tie plate wear.

RAILROAD ACCESSORIES CORPORATION

MAIN OFFICE

405 LEXINGTON AVENUE

(Chrysler Building)

NEW YORK

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 25 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

NORDBERG POWER TOOLS
FROM START TO FINISH

Two Spike Pullers removing spikes from old rail

Three Adzing Machines surfacing ties for seating new rail

Two Power Wrenches tightening joints of the new rail

Seven machines serve this rail laying gang

Watching the different operations on this rail-laying job one is impressed with the use of Nordberg machinery. The spikes are being removed by two Spike Pullers doing the work that normally would require 12 to 15 men if the spikes were pulled by hand. These are followed by three Adzing Machines, providing perfectly adzed tie seats for the new rail. At the end of the gang are two Power Wrenches applying the nuts to the joints of the new rail and tightening every joint to uniform tightness.

This mechanized rail-laying gang is typical of the practice being followed by most of America's leading railroads. These and other Nordberg maintenance tools were developed for a specific purpose, — to do track work better, quicker and at less expense.

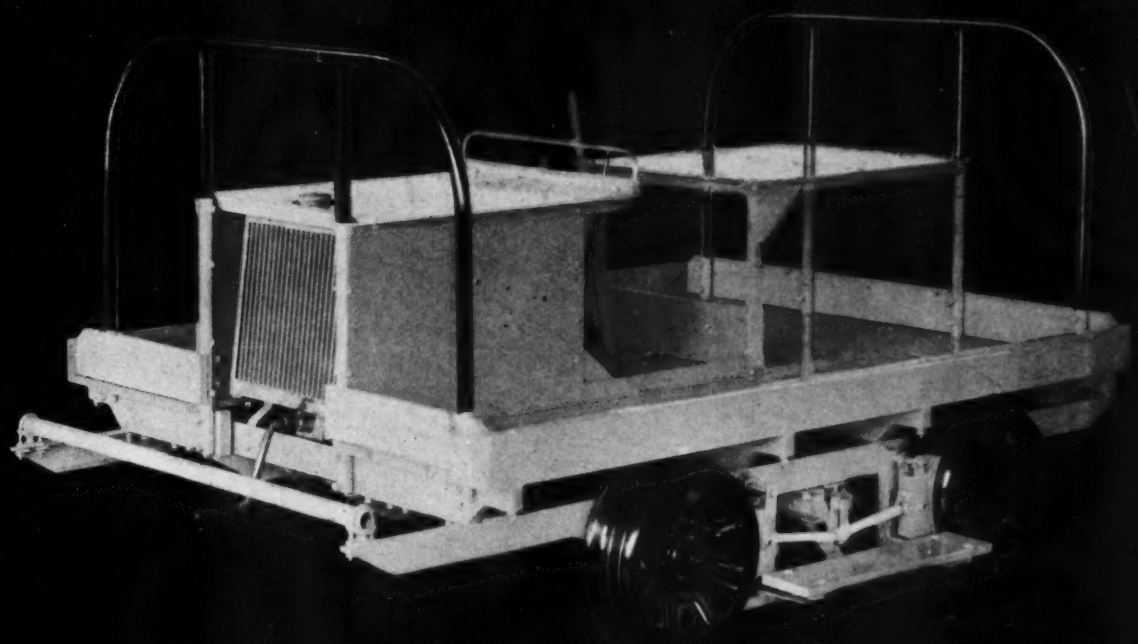
NORDBERG MFG. CO.
MILWAUKEE, WIS.

Photographs — Courtesy of Railway Educational Bureau

Nordberg Power Tools Developed For Your Maintenance Jobs

Adzing Machine *Spike Puller* *Power Wrench*
Utility Grinder *Rail Drill* *Rail Grinder*
Power Jack *Track Shifter*

PERFORMANCE ON THE JOB COUNTS



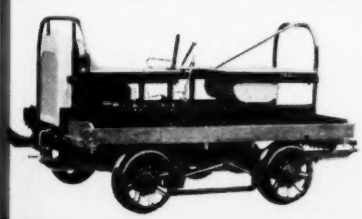
A3 SERIES B

B AND EXTRA GANG CAR ••• 20 HORSEPOWER

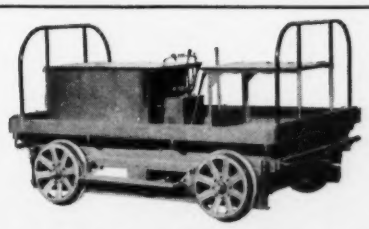
Again Fairmont leads—this time in the heavy duty field—with more power, more economy, more safety and more accommodation. In this Series B Car the advance is typical of all Fairmont development, for it is, fundamentally, the A3 which has served so long and so well. It brings to gang work an outstanding improvement in power by the adoption of the Hercules Engine which permits equipment with generator, battery, self-starter and headlights—or retention of magneto ignition where desired. This new power plant delivers more power at lower cost and delivers it with greater flexibility for varying loads and speeds . . . developing 7 H. P. at 900 R.P.M.; 17 H. P. at 2,000 R. P. M.; 20 H. P. at 2,500 R. P. M. The Fairmont heavy duty reversible transmission provides four speeds in either direction.

The improvements effected in this new car reflect the spirit of Fairmont engineering which is consistently centered on the refinement of time-tested units . . . for lower operating costs and for lower maintenance through simplified design requiring fewer parts. Fairmont Railway Motors, Inc., Fairmont, Minn.

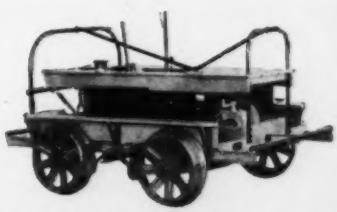
Inspection Motor Cars . . . Section Motor Cars . . . B & B and Extra Gang Cars . . . Gas-Electric Ditchers . . . Shapers . . . Ballast Cleaners . . . Ballast Drainage Cars . . . Mowers . . . Weed Burners . . . Extinguisher Cars . . . Power Cars: Air, Electric, Paint Spray, Tie Tamping . . . Rail Coaches . . . Motor Car Engines . . . Push Cars and Trailers . . . Roller Axle Bearings . . . Wheels and Axles.



A5 Series B—Gang Car—32 H. P.—4 Cylinders, 4 Speeds Either Forward or Backward.



● A6 Series B—Gang Car with Ford V-8 Engine. Spring Mounted—80 H. P.



● ST2—B & B and Extra Gang Car. Low Gear Starts Trailers Quickly.

FALL THE RAILWAY MOTOR CARS IN SERVICE TODAY

Fairmont

More than Half are Fairmonts

Fifteen-hundred 24-inch octagonal precast concrete piles are being used in the $1,400,000 track elevation of the L. & N. Railroad through Louisville. G. R. Smiley, Chief Engineer of the L. & N. WPA project under direction of Kentucky Highway Dept., T. H. Cutler, Chief Engineer; Wallace W. Sanders, Dist. Engineer. General contractor, Henry Bickel Co., Louisville. Pile manufacture and driving by Western Foundation Co., Chicago.

NEW BOOKLET GIVES PRACTICAL FACTS ON

CONCRETE PILES

For bridge foundations, buildings, docks, track elevations, trestles

Just off the press comes the manual, "Concrete Piles—Design, Manufacture, Driving."

This booklet presents data and experience never before assembled in one handy reference. It has chapters on how to determine foundation conditions; test piles; pile driving formulas; estimating load capacities; design, manufacture and handling of pre-cast piles; cast-in-place piles; and similar subjects. Fundamentals are discussed in sufficient detail to help the designer analyze and solve foundation problems involving piles.

Concrete piles merit careful consideration for any location where piles are needed. They may be made to any length and size desired. And they are the most economical of all pile types on the logical basis of cost per ton of load carrying capacity.

Clip coupon and send in now for *free* copy.

PORTLAND CEMENT ASSOCIATION
Dept. 2-27, 33 W. Grand Ave., Chicago, Ill.
Please send me free copy of "Concrete Piles —Design, Manufacture, Driving."
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Fitting-up Bolts 4 to 10 Times Faster

Restoring Bridge to Service In Minimum of Time

The I-R Impact Wrench handles bolting-up work in about one-tenth of the time required by hand. It speeds bridges back into service and minimizes interference with train schedules.

On the job shown above the Impact Wrench reduced the bolting-up time 72% and enabled the resumption of full speed traffic 13 hours sooner.

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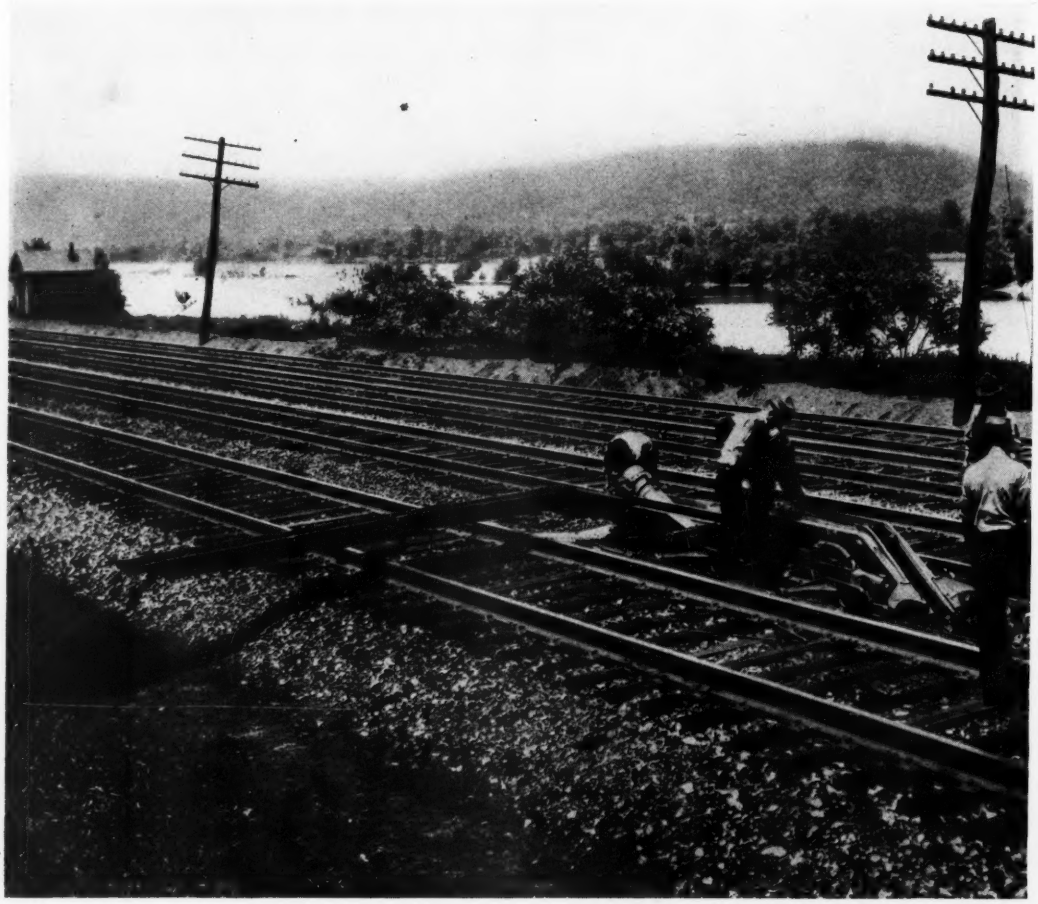
MOLES

Clean Ballast Without Obstructing Tracks



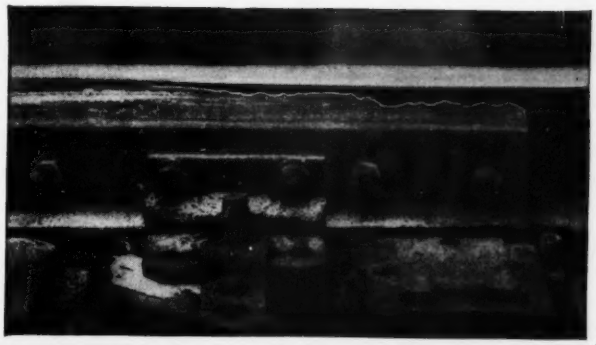
The INTERTRACK MOLE will efficiently and economically clean additional ballast cribbed from adjoining tracks.

MOLES are cleaning ballast at less than 4c per lineal foot of intertrack or border, including all charges for labor, fuel, repairs, depreciation and interest.

RAILWAY MAINTENANCE CORPORATION
Pittsburgh, Pa.

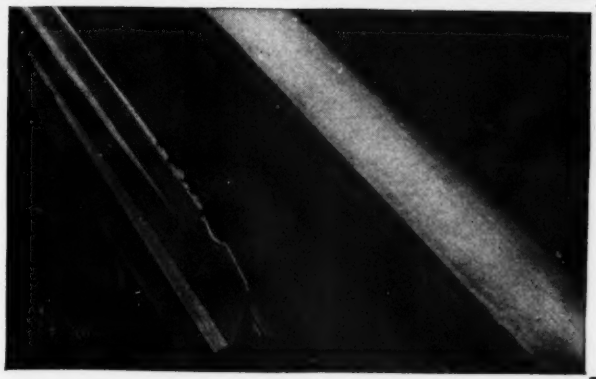
SAMSON SWITCH POINTS

for Safety and Economy



THIS

Ordinary knife-blade switch points usually look like this after but one year at busy points. They chip and break down. This condition means danger to equipment and lading in yards and cannot be tolerated on main line turnouts.



SAMSON

These Samson Switch Points have been at a busy spot for 3 years, and are good for many more years. This means labor and money savings and uninterrupted high speed traffic.

or

THIS

RAMAPO AJAX CORPORATION

CANADIAN RAMAPO IRON WORKS, LIMITED

RACOR

General Offices: 230 Park Avenue, N. Y.

RACOR

RACOR WORKS: Hillburn, New York • Niagara Falls, N. Y. • Chicago, Ill.

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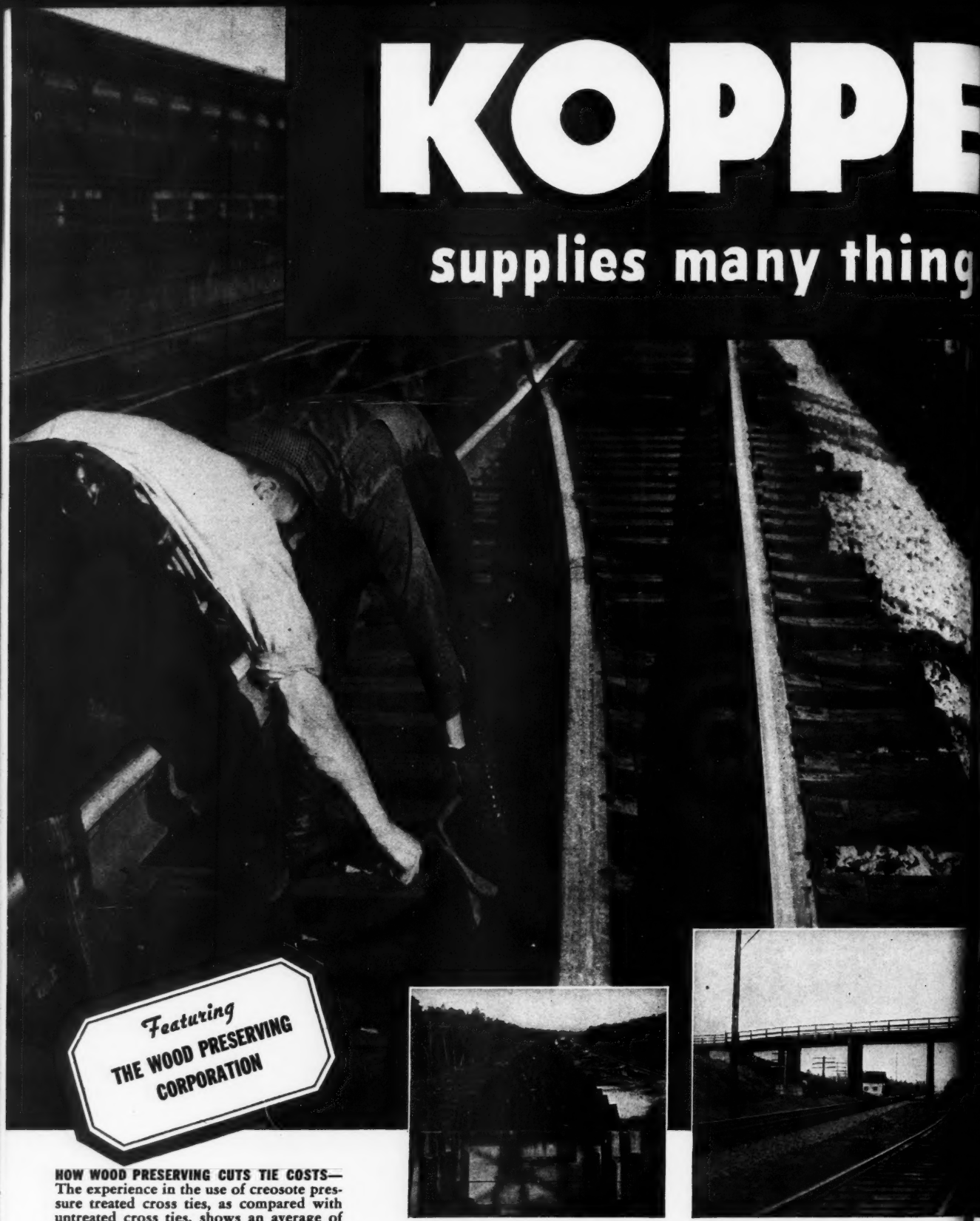
KOPPE

supplies many thing to



Featuring
THE WOOD PRESERVING CORPORATION

HOW WOOD PRESERVING CUTS TIE COSTS— The experience in the use of creosote pressure treated cross ties, as compared with untreated cross ties, shows an average of three times longer timber service life. The use of treated material results in low annual renewal and maintenance costs and gives undisturbed safe track. The Wood Preserving Corporation, subsidiary of Koppers Company, supplies and treats ties for railroad use.

TREATED TIMBER FROM THE WOOD PRESERVING CORPORATION WAS USED IN THIS CONSTRUCTION— The Wood Preserving Corporation, Koppers subsidiary, supplies the railroad field with pressure treated cross ties, piling, bridge and dock timbers, poles, cross arms, fence posts, crossing plank, cribbing, conduit and car stock. Wood is treated with creosote oil or with salt preservatives, depending upon the service required. Wood-working plants bore and adze cross and switch ties and fabricate lumber and timbers for all types of railroad use.

KOPPERS COMPANY, PITTSBURGH, PA. . . . DESIGNERS . . . BUILDE RODU

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ng to the railroads

Koppers Divisions, Subsidiaries and Affiliates Serving the Railroads

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TAR AND CHEMICAL DIVISION, PITTSBURGH, PA.
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BARTLETT HAYWARD DIVISION, BALTIMORE, MD.
AMERICAN HAMMERED PISTON RING DIVISION, BALTIMORE, MD.
WESTERN GAS DIVISION, FORT WAYNE, IND.
THE WHITE TAR COMPANY OF NEW JERSEY, INC., KEARNY, N. J.
THE MARYLAND DRYDOCK COMPANY, BALTIMORE, MD.
GAS AND COKE DIVISION, PITTSBURGH, PA.

AMERICAN HAMMERED PISTON RINGS USED IN MANY LOCOMOTIVES—This Rock Island switching engine has an Ingersoll-Rand Diesel engine, with American Hammered Piston Rings.

KOPPERS COAL IS USED BY RAILROADS—Koppers is one of the leading coal producers and shippers.

KOPPERS ROOFING AND WATERPROOFING CUT RAILROAD MAINTENANCE COSTS—Railroad men know that roof maintenance is a serious problem. Roofing failures can be avoided by specifying Koppers Coal Tar Pitch and Tarred Felt on all flat roofs. Coal tar products are able to withstand the prolonged contact with water which is the most frequent cause of troubles. Koppers Coal Tar Pitch and Koppers Tarred Felt and Fabric are used on much railroad waterproofing work.

KOPPERS COMPANY, Pittsburgh, Pa. REM-2

Send me information about

- ☐ Pressure-treated Ties, Poles, Posts, and other Treated Timber
- ☐ Bituminous Base Paints
- ☐ Coke
- ☐ Roofing
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Your Name.....

DE RODUCERS . . . MANUFACTURERS

ANOTHER SUCCESSFUL NON-SHRINK EMBECO JOB

A feature of the work which proved of advantage was the use of Embeco grout in setting the short ties, a grout which not only produced early high strength, but which had no shrinkage during setting and curing. Through the use of this grout, it was possible to restore traffic to the tunnel shortly after the work was completed, and firm permanent anchorage of the tie blocks in the concrete was assured without the usual shrinkage cracks surrounding them to admit moisture and hasten their decay.

Eleven months after the completion of the work in the tunnel, a careful inspection of the floor showed it to be in perfect condition, with no detectable shrinkage of the grout around the blocks. As a result, the rails were in as good surface and alinement as when laid, with no apparent reason why this condition should not continue indefinitely so far as the floor structure is concerned.

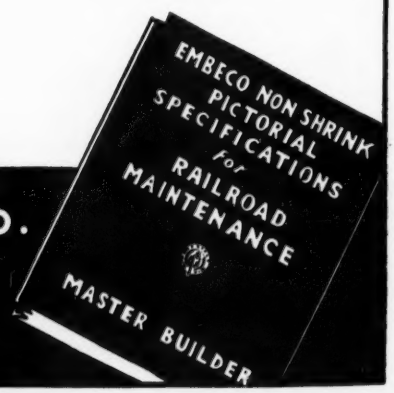
● *Reprinted from the January 9 issue of Railway Age, the above excerpt clearly reveals one important reason why* Non-Shrink *Embeco has earned the hearty endorsement of railroad engineers and maintenance men!*

Non-Shrink Embeco once more demonstrates its unique ability to completely eliminate shrinkage in concrete!

In grouting, in the repair and restoration of all concrete structures, *Non-Shrink* Embeco has enabled engineers and maintenance men of scores of major railroads to make easy and simple many ordinarily difficult tasks . . . for *Non-Shrink* Embeco is quick-setting . . . attains high early and great ultimate strength . . . is permanently oil and waterproof . . . builds into concrete greater density and greater durability!

Non-Shrink Embeco is a specially prepared metallic aggregate, which, when mixed with Portland cement and sand, creates concrete that cannot shrink!

● *Write now for this book of complete pictorial specifications!*



THE MASTER BUILDERS CO.

CLEVELAND, OHIO — TORONTO, ONTARIO

Demonstrated Ability

Cletracs in Railroad Service

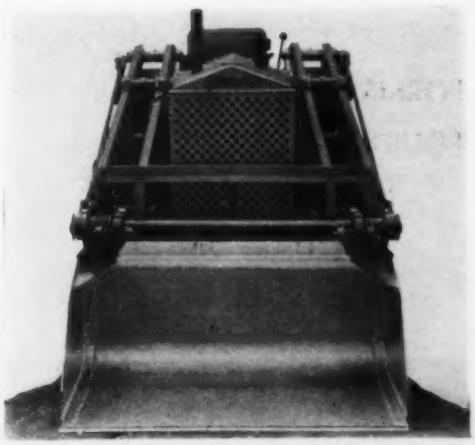
CLETRACS were introduced five years ago as a new factor in railroad maintenance.

CLETRACS since then have proven without question their adaptability to the railroad industry.

CLETRAC OFF-TRACK compressor units, welding generators, front end loaders, bulldozers, snow plows and other types of equipment are actually at work on many railroads.

Let us tell you how and why this equipment will do more work for your maintenance dollar.

The Cletrac
Front End Loader



THE CLEVELAND TRACTOR CO., Cleveland, Ohio

Cletrac
Crawler Tractors
Built To Endure

We extend a cordial invitation to visit our exhibit at the National Railway Appliances Show at Chicago, March 15th to 18th, Spaces 14, 15 and 16.

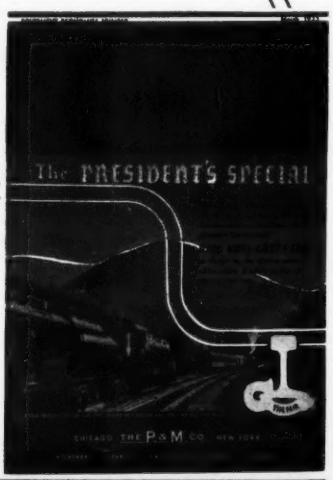
TO RAILWAY SUPPLY MANUFACTURERS

Maintenance Work Is Mechanized Work

The railways constitute a large and rapidly growing market for mechanical equipment. They appreciate its advantages.

Greatly enlarged programs are in the making. These programs require more and better equipment. Maintenance officers are, therefore, especially interested in new and modern equipment now.

The March issue of Railway Engineering and Maintenance, as for 19 years, will focus attention on equipment. It will feature its economies. It will contain the sales stories of many equipment manufacturers. Will yours be there?



FORMS FOR THE MARCH EQUIPMENT ECONOMIES NUMBER CLOSE FEBRUARY 20.

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

RESILIENT **ADJUSTABLE**

BETHLEHEM SPRING RAIL BRACE

simplifies maintenance on high-speed track

Here is a simple, effective rail brace that gives ample support against side thrusts, yet has sufficient resilience to absorb shocks without permanent displacement. Being also adjustable, this brace greatly simplifies the work of keeping track in the precise alignment so important for high-speed service. It is easy to install, requiring no special tools. Rugged construction assures long life.

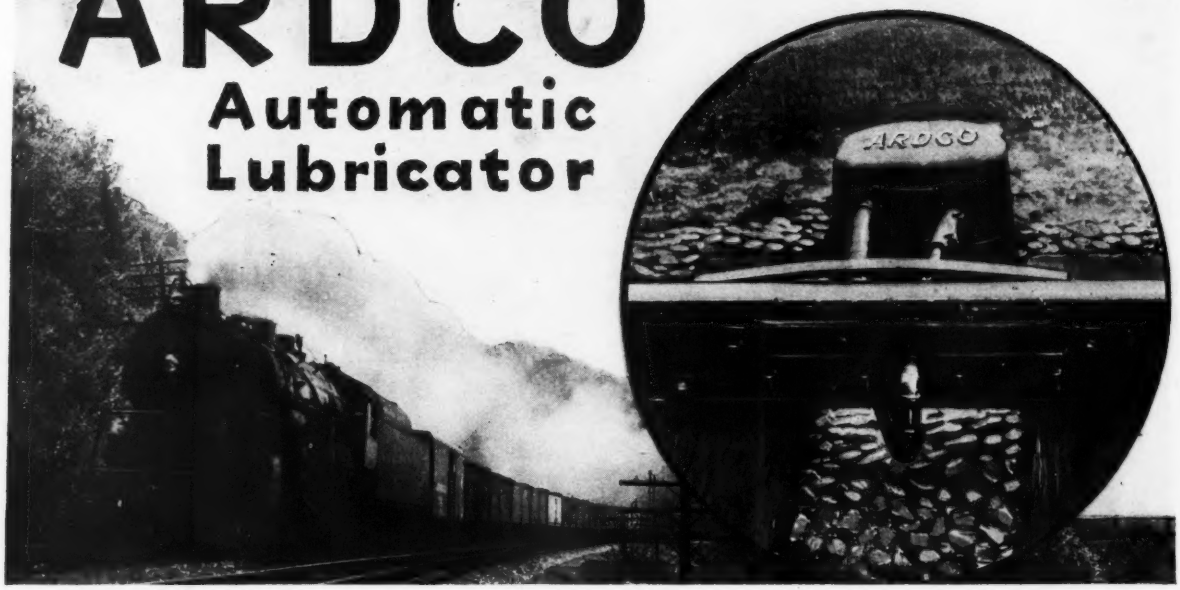
Construction... The Bethlehem Spring Rail Brace has only two parts—a rigid base consisting of a brace solidly welded to a rolled-steel switch plate—an adjustable wedge, embodying a heavy angular-shaped piece of spring steel. The wedge is driven into place with any sort of hammer; a pawl drops into a slot, locking the wedge to the brace. Side thrust on the rail is absorbed by the spring—it will cushion a compression force of at least 12,000 pounds before the spring closes against the stop.

Adjustment... The brace can be adjusted at any time by lifting the pawl, driving the wedge further in, and dropping the pawl into a new slot. Adjustments are in 1/16-inch steps, and the range is ample to compensate for variations in dimensions of rail and plate. The brace complies with AREA Standards and has been found by many roads to be a highly satisfactory and an economical solution to the problem of rail bracing at turnouts.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

ARDCO
Automatic Lubricator



Dependable—Efficient and Economical . . . . .

SUMMER AND WINTER—in blistering hot weather or zero temperatures when the right of way is covered with ice and snow you will always find an ARDCO Automatic Rail Lubricator working.

And you will find ample evidence of efficiency—grease right on the throat of the rail where you need it—way around to the end of the curves you want lubricated.

You do not have to worry about ARDCO Automatic Lubricators wasting grease or requiring periodical attention. Performance of hundreds of installations prove that they are exceptionally economical to operate and maintain.

The dependability, efficiency and economy of ARDCO Automatic Lubricators insure maximum returns from rail lubrication.

ARDCO MANUFACTURING CO.

1 NEWARK ST. HOBOKEN, N. J.

DON'T LET "RED DISTRICTS" INCREASE YOUR OPERATING COSTS

● Be prepared for 1937 competition by starting now to improve your "red districts"—those sections of track where your operating costs are high, due to slow orders and excessive maintenance. Remember, there is a way to make those districts *earn* money for you, instead of spending it.

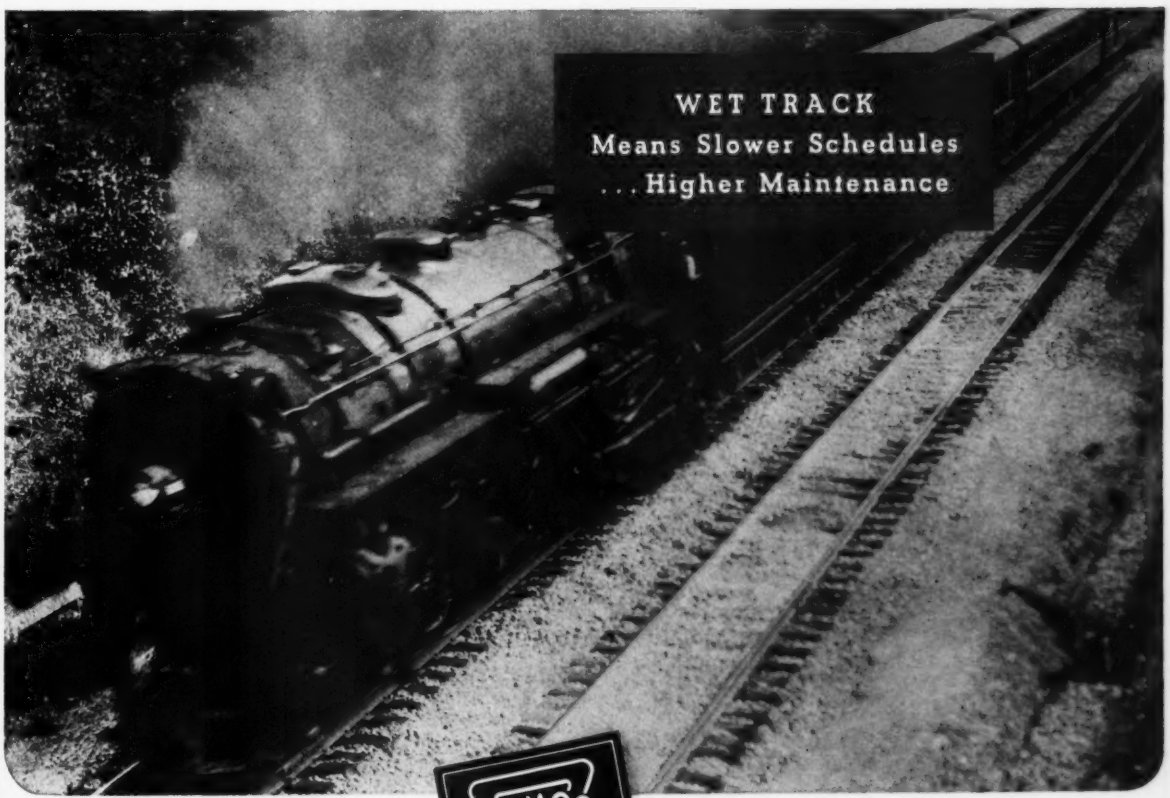
The way lies through a *systematic program of subdrainage*. This has been proved time and again by every railroad that has adopted it. Slow orders have been eliminated. Safety and passenger comfort have been improved. And maintenance costs, on one road alone, have been reduced as much as 14 million dollars the first year.

Being specialists in subdrainage, Armco engineers are in a position to offer capable and helpful assistance to your own maintenance staff—without obligation, of course.

INGOT IRON RAILWAY PRODUCTS COMPANY
(Member of the Armco Culvert Mfrs. Assn.)
Middletown, Ohio • Berkeley, California
PHILADELPHIA • DALLAS • ATLANTA • SALT LAKE CITY
MINNEAPOLIS • LOS ANGELES • ST. LOUIS • PORTLAND
CLEVELAND • SPOKANE • CHICAGO • RICHMOND
HOUSTON • DENVER

★ ★ ★

Every railway executive interested in economy should have a copy of this 8-page bulletin, "How to Lower Maintenance Costs—by Stabilizing Track Foundations." Just address our nearest office for your free copy.



SAVE WITH ARMCO SUBDRAINAGE

PRINTED IN U.S.A.

No. 98 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Food for Thought

February 1, 1937

Dear Reader:

In these days when all of us take for granted so many services that are all but indispensable, we of the staff of Railway Engineering and Maintenance frequently wonder whether our magazine is really filling as definite a place in your work-a-day lives as we like to think that it does, for there are so many of you whom we never hear from year after year. Yet, occasionally something happens accidentally that gives us a measure of the value of our service. Such an incident was revealed in a letter that I received a few days ago from a roadmaster on an eastern railway.

Owing to interruptions in normal schedules resulting from the Christmas and New Years holidays, our last issue did not go into the mails until January 7, six days late. Apparently further delay ensued in the mails for this roadmaster wrote me on January 15 as follows:

> "The roadmaster's office of subdivision E did not receive its January issue of Railway Engineering and Maintenance until today. The reason for this delay is unknown to me, but we missed the issue very much.
>
> "Every morning someone rushed downstairs when the mail came in to see if this issue had arrived. Of course, there was a reason for this interest, as we use every issue at our safety meetings and when we transfer from safety to track work in the afternoon, all available copies of the magazine go into play, since almost every foreman on this part of the railroad is a subscriber.
>
> "I am not writing you in a spirit of criticism, but to let you know that we have reached a point where this magazine is our daily food for thought concerning our program of work and when it fails to arrive, we feel a great loss."

This letter gives us a new and fresh conception of the confidence you are placing in us. It puts us on our toes to insure that we do not fail you. And it may suggest to you further uses to which you may put your copy.

Yours sincerely,

Elmer T. Howson

ETH*JC

Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

Entirely

A ONE-MAN TOOL

Carried by ONE MAN
Operated by ONE MAN

A section hand can pick up and carry all the necessary equipment ready for work if he is equipped with a BARCO.

This portable gasoline tool does tamping fast, efficiently and at an hourly operating cost of but a few cents. In spot or gang tamping the BARCO Unit Tytamper drives the ballast under the ties forcibly enough to keep the rails and joints at proper level. Packed with plenty of power the BARCO handles crib-busting and is very useful in breaking and chipping ice in terminal switches and cross-overs. Entirely self-contained, no make-ready for auxiliary equipment is necessary.

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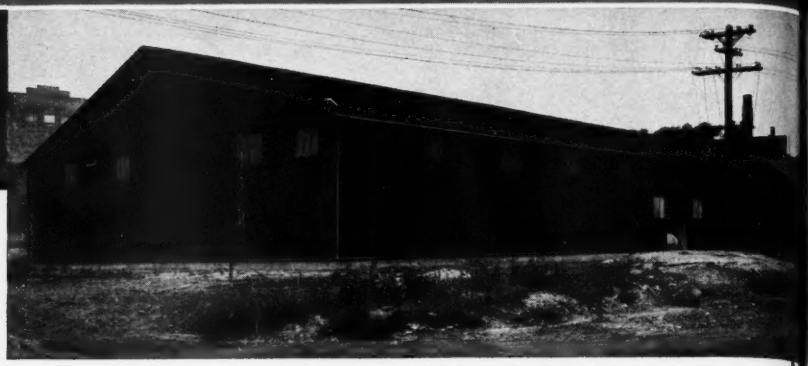
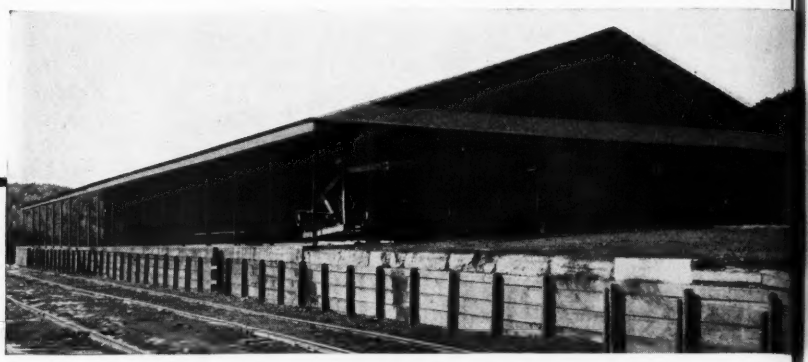


In 1922, the Truscon Standard Building, illustrated above, was erected as a storage structure for a midwestern newspaper publisher. In 1925, a railroad purchased the building, dismantled it, moved the units to another city and re-erected it, as illustrated below. Today, this Truscon Building is as good as new!



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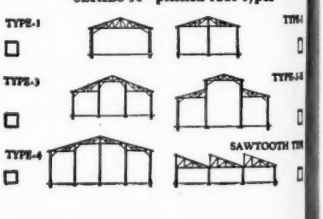

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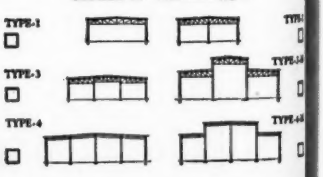

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February, 1937

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Railway Engineering and Maintenance

Recovery

The Contribution of the Railways

THE problem that overshadows all others in our national life today is unemployment. The one objective that is universally desired is a job for every workman—and the elimination of further necessity for public relief. In the search for means to bring these objectives to pass, it is well to determine the sources of the trouble and to ascertain the conditions that brought it about.

The railways comprise one of the country's great industries. They extend into every community. They employ large numbers of men. They purchase large quantities of materials. These facts are accepted without thought. But consideration is seldom given to the further fact that this employment and these purchases are made possible only by adequate railway earnings; that without them, both employment and purchases must decline and, conversely, that with increased earnings both employment and purchases will rise. When this fact is realized, the maintenance of adequate railway earnings is lifted from the status of mere corporate interest to one of public concern.

Direct Employment

Take the question of direct railway employment. In the years from 1923 to 1929 the railways employed more than 1,750,000 persons and their payrolls exceeded $2,900,000,000 annually. Yet in 1933, the average number of employees had declined to 971,000 and the aggregate annual payroll to $1,404,000,000. In other words, within four years the railways had been forced to discharge or furlough more than three quarters of a million men—a very definite addition to the ranks of the unemployed—with a loss in wages of $5,000,000 every working day.

And in 1936, when traffic was still 22 per cent below the 1926-1930 level, the railways employed 100,000 more persons than in 1933 and paid them $390,000,000 more; in other words, they poured into the pockets of wage earners more than 1¼ million dollars of *added* wages each working day. If we compare 1936 with the year immediately preceding, the railways provided employment within the last year for more than 70,000 additional persons, and added to the wages of the country some $157,000,000.

And this is only part of the story. They contribute equally directly to industrial prosperity through the purchases that they make from other concerns. In 1926-1930, inclusive, the railways purchased from manufacturers materials and supplies aggregating more than $1,100,000,000 per year. In the five years ending with 1935, their purchases averaged only $380,000,000—a decrease of $720,000,000 per year. In other words, in these five years the railways reduced their purchases from manufacturers more than $3,500,000,000 and these manufacturers were in turn forced to reduce their payments for labor and for raw and semi-finished materials accordingly. The effect of this retrenchment on employment can be appreciated when it is realized that from 50 to 85 per cent of the cost of the materials used by the railways goes for labor at some step in the process of manufacture. On this basis, this further and indirect contribution approached the direct contribution in numbers of men driven into the ranks of the unemployed.

Here likewise, the converse effect has also been evident of late as railway earnings have begun to increase, for the roads have returned these earnings into the channels of trade immediately through larger purchases of the materials and supplies and equipment that were so sorely needed. As a result, their purchases from manufacturers increased from $403,000,000 to $727,000,000 last year, a total more than 2½ times as large as that of three previous years.

The result of this increased buying is widespread, for when a railway orders rails, for illustration, the effect is felt first in the steel mills, but it soon extends back to the ore and coal mines and other sources of raw materials, as well as to the railways themselves through the transportation of these materials from mine to mill. In this way, it is estimated that at least $200,000,000 has been added directly to factory payrolls by the added orders that the railways placed for materials last year, giving employment to more than 100,000 men. And these orders were still far below normal volume and far below the needs of the railways but were limited by the funds available. If this increased indirect payroll be added to that of the railways, this one industry provided *added* employment for 170,000 additional men last year and placed more than $350,000,000 additional money in circulation.

A Widening Circle

And this is not all, for this money that went for labor was in turn spent for food, for clothing and for all the varied needs of the individuals, providing income not only for shopkeepers and tradesmen but also for those who made the products for their shelves. In other words, these expenditures of the railways set in motion an ever-

widening circle of activity that runs into vast figures. It is this larger influence that measures the full effect of the contribution of the railways when they buy.

The contribution which the railways have already made to re-employment is outstanding. It is but a start, however, towards what they can and will do if they are relieved of the arbitrary and unfair handicaps to which they are now subjected in their competition with transportation agencies on the highways, on the waterways and in the air. Freed of these shackles, they can recover a large part of the traffic they have lost and as they recover it they can and will provide employment for the more than 600,000 former railway employees and for at least an equal number of men in the shops and factories that are producing the materials required by the railways.

No other transportation agency makes a corresponding contribution to national prosperity. The amount of employment provided by the air lines and by the waterways is infinitesimal compared with that of the railways, while that employed on the highways is far inferior in wages and in working conditions.

The railways are our most dependable transportation agency; they are our safest agency; they are also our most valuable agency in the contribution they make to our national welfare.

Rail End Hardening

Now a Practice of Recognized Economic Merit

The adoption by the Atchison, Topeka & Santa Fe of the end hardening of rail ends as standard practice, as described in an article beginning on page 97 of this issue, signalizes the "coming of age" of a practice that had its inception during the lean years of the depression. During that period, when maintenance budgets were pared almost to the vanishing point, various expedients were adopted by maintenance of way departments in their attempts to reduce expenses. Some of these measures were admittedly of but temporary benefit and in the aggregate accomplished little in reducing the rate at which deferred maintenance was accumulating. Others, because they effected actual conservation of materials or in other ways resulted in a real reduction in expenses, represent definite and valuable contributions to the methods of maintaining tracks and structures. Among the latter practices is the end hardening of rail ends by heat treatment.

Rail-joint maintenance has long constituted a major problem for maintenance men. Probably the most important single element of this problem has been rail-end batter which, because of its effect on wheel impact at the joints, is an important factor contributing to the development of such conditions as low joints, loose bolts, and wear of the top surfaces of the angle bars and of the undersides of the rail heads. It is largely because of rail-end batter, therefore, that it has been necessary to devote so large a part of the track maintenance allotments to the upkeep of the joints. Recognizing these facts, the Santa Fe was quick to examine the possibilities of rail-end heat treatment as a means of preventing batter, and, when experiments demonstrated the efficacy of the practice, it was equally quick to adopt it as standard.

This decision is significant, not only because of the broad application of the heat-treating process that is implied (approximately 500 track miles of rail will be end-hardened this year), but because it represents the action of a financially stable carrier that is in a position to subject proposed practices to most critical analysis, weighing the long-term (rather than immediate) savings and benefits against the initial cost, before accepting or rejecting them. Therefore, the action of the Santa Fe in regard to the heat-treating of rail ends may be said to place this development among those maintenance of way practices whose economic merits are demonstrated.

A Disparity

What Price Shabby Passenger Stations?

NO MORE dramatic chapter of industrial history has ever been written than that which will some day be recorded concerning the comeback of the railways during the fourth decade of the twentieth century. During the first half of this period, when the growing decline of business and competing forms of transportation were sapping the lifeblood of the roads, many thought that they saw the twilight of transport on rails. But the depth of the depression had scarcely been reached before the railroads became imbued with a new spirit—first in the minds of a few executives and eventually throughout the entire personnel.

Manifested in its most spectacular form by the advent of the streamliner, this new spirit has stimulated a concerted effort to recapture the business lost to competitors, but it is in the measures to make passenger travel by rail more attractive that the railways have made the most effective appeal to the public.

Lower fares, faster trains, air-conditioning and more attractive and comfortable cars, plus a safety record that is not even approached by any other agency, have attracted increased patronage. But is that enough? Every passenger who rides a train that is the last word for economy, safety, speed, comfort and beauty must board it at one station and alight at another. But do the buildings, grounds, accessory facilities and platforms at these stations conform to the standards of comfort and esthetics that have been established for the train The obvious answer is that in most cases they do not.

It has been said of merchandising that success depends not only on the quality of the goods and the price, but also on the environment under which the sale is consummated. All of which explains why oil companies employ architects to design gas stations and moving picture exhibitors spend so much money for gorgeous lobbies. There is, in fact, a distinct parallel between the picture house lobby and the station waiting room because passengers spend about as much time waiting for trains as theatre patrons do in waiting for the "next show" to start.

It does not follow that the railroads would be justified in expending vast sums in a general program for the construction of new stations, but there is something decidedly out of joint when a splendid modern train makes a service stop at a station that is sadly in need of

paint, is poorly lighted, lacks sanitary toilet facilities, has a wornout floor and is flanked by a cinder platform. Obviously, any pronounced change in policy as to expenditures for the upkeep or reconditioning of stations is a function of the managements, but the maintenance officer can direct attention to the disparity in the physical standards of stations and trains in presenting his case for more liberal maintenance appropriations.

Painting

Is Anyone Fooled by Cheap Materials?

IF ONE were inclined to belittle the neglect in bridge and building painting that has occurred on the railways during the last six years of depression, his eyes were undoubtedly opened by the article in the October issue concerning the status of railway painting. In that article, which reviewed the painting situation on 37 railways with a total of more than 168,000 miles of lines, most of the roads conceded that they were considerably behind on bridge painting, and woefully behind on building painting. The conclusion was that the railways as a group are at least four to five years behind in their painting, which, in view of their thousands of bridges and buildings, means that there is a vast amount of work to be done to bring railway painting back to a normal basis.

No criticism is implied in a statement of this situation. The railways have been confronted with the most severe and prolonged curtailment of traffic and income in their history, a situation which called for drastic retrenchment. In the reduction in the amount of money spent for painting, for both bridges and buildings, the railways found an immediate means of economy which in no way affected the safety of rail transportation or the convenience of their passengers. It was realized that while the curtailing of painting programs might affect the appearance of structures and cause some offense to the public, particularly in the case of passenger stations, it was possible to reduce the amount of painting being done over a reasonable length of time with little injury to the structures themselves.

When the depression set in, few railway men anticipated the severity and duration of the conditions that were to prevail. Therefore, while the initial curtailment of painting was done without much hesitancy, the prolonged curtailment caused railway maintenance officers the deepest concern. In an attempt to arrest the deterioration of structures, many emergency measures have been employed, including the application of types of protective coatings which, under normal conditions, would not be considered; coatings which, at best, promised only limited life and protection.

It is common knowledge in the paint industry that many inferior paste and oil paints on the market cost as little as 15 to 20 cents a gallon to manufacture, and, in spite of the most impressive labels, often contain as much as 30 to 40 per cent of water and the cheapest of pigments and reducing oils. A deceiving feature of many of these coatings is that they present a high quality finish immediately upon application, and, through particular characteristics of their ingredients, often flow readily and have unusual covering qualities. It is needless to say that these characteristics in an otherwise inferior paint are practically worthless when considered from the standpoint of railway structure painting, where sustained protection and appearance over the greatest period of time provide the only economical basis for judgment.

With the labor cost of applying paint practically twice that of even the best of material, and considerably in excess of this where a large amount of scaffolding and surface preparation is required, it is difficult to understand why any road, even under unfavorable conditions, would consider applying, knowingly, inferior paint materials, unless its back was absolutely to the wall, and incomprehensible that with improved conditions, a practice of this character should be long continued. Fortunately, most engineering and maintenance of way officers realize that the use of materials of high quality is not only essential to economy in painting work, but that to employ inferior materials comprises an unwarranted waste of both labor and money.

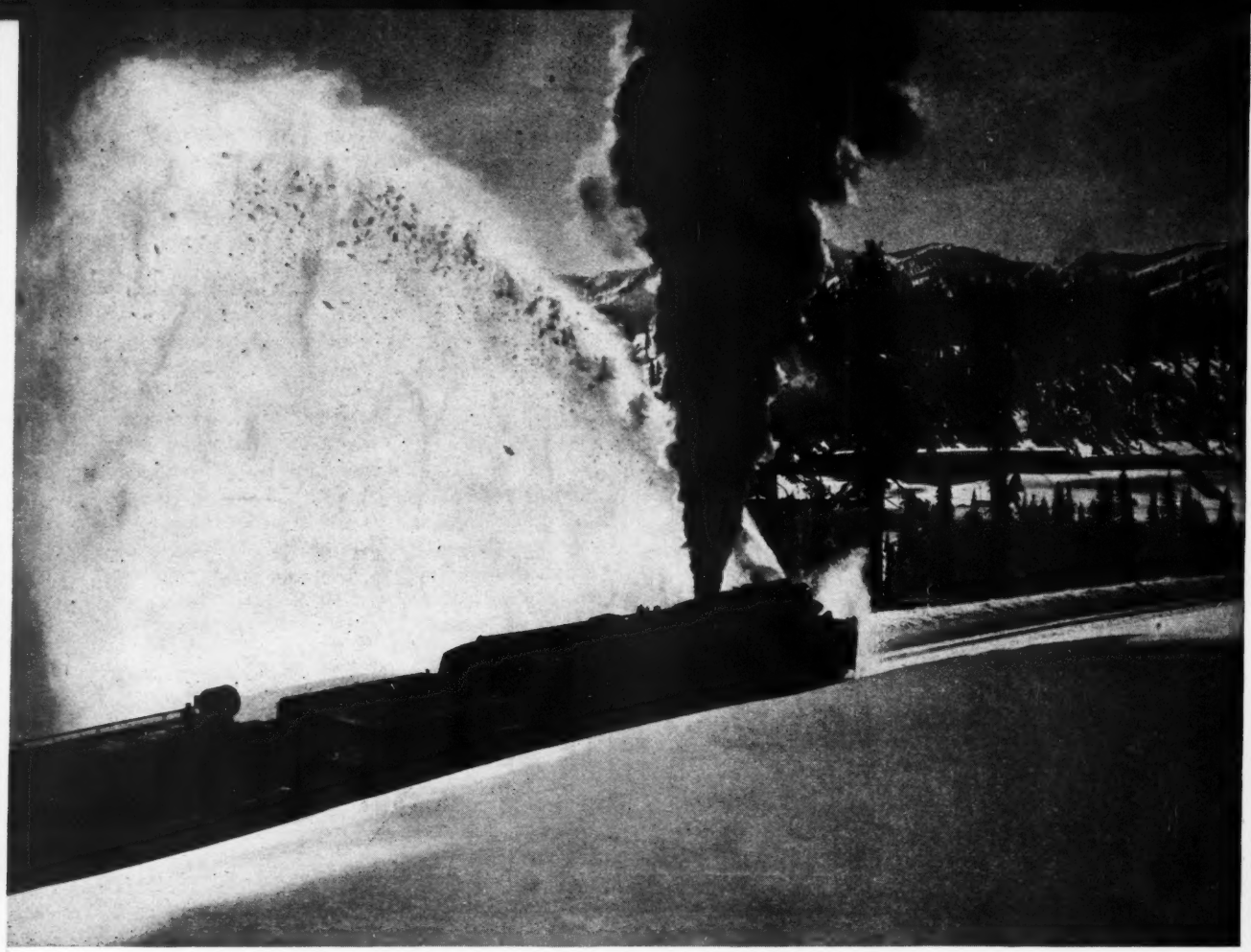
High Speed

Affects Bridges As Well As Track

DURING the last three years there has been a great deal of discussion of the effect on track of the lightweight high-speed passenger trains which various roads have been placing in service. This discussion has centered largely around changes in organization of the track forces and new methods of track maintenance to meet the problems created by these higher speeds. Some attention has also been directed to the possibility that a new form of track construction, or perhaps a modification of the present form, may be necessary. Another thought-provoking comment has been that the present so-called superspeeds represent only the beginning and that, as experience is gained in operation, design of equipment and the effect of speed on the track, speeds which the imagination yet fails to grasp may become common.

So far, these discussions have been limited to track and alinement, the latter being important also, for at present curvature forms the principal obstacle to uniformly sustained high speed. Heretofore, public discussion has included no reference to bridges, the assumption apparently being that they are not affected by the increases in speed. However, as indicated in a report presented before the convention of the American Railway Bridge & Building Association, which was abstracted in the November issue, the effect of the speed of trains on bridges must be taken very definitely into account.

Another point which is worthy of special mention is that the personnel of the bridge-maintenance forces is assuming a new importance. In fact, one road has already found it necessary to pay special attention to the training of foremen to direct the bridge gangs which are assigned to those lines over which trains are being operated at the higher speeds. The importance of personnel does not end with the foreman, however, since it has been found also that the men in the gang must be more alert and active than they were required to be formerly.



One of the Giant Rotary Snow Plows in Action Near Truckee, Cal.

Keeping a Line Open in 40 Feet of Snow

WHILE the fighting of snow is no novelty to most railway maintenance officers, few of them are called on to battle snow in the quantities encountered by the Southern Pacific in its crossing of the Sierra Nevada mountains in California. Yet, so regularly do these storms occur year after year that the officers of this road accept the task of clearing the line during and after storms as a more or less routine matter.

Not only is the total annual snowfall heavy on this line, amounting in some years to as much as 65 ft., and varying in normal years from 33 to 45 ft., with as much as 15 to 25 ft. on the ground at one time, but not infrequently the snow falls at the rate of a foot an hour, sometimes maintaining this rate for several hours. To increase the difficulty of keeping the line clear, it often happens that before the effects of one storm are fully cleaned up, another storm of equal severity makes it necessary to do the work over again, with the added disadvantage of having to contend with the earlier snow piled high along the tracks.

Despite these severe conditions, it has been years since this line has been tied up because of snow. In fact, through long experience in fighting snow under particularly adverse conditions, the use of a well-developed snow-fighting organization, employment of the most modern equipment and adequate advance preparation, it is a rare occurrence when either freight or passenger trains are subjected to more than nominal delay.

Five Critical Points

Five points in particular are known as winter trouble points on the Southern Pacific, although heavy snows occur also on other parts of this road. These points are the crossing of the Sierra Nevada mountains in California and Nevada; the Canyon of the Sacramento river in California; around Mt. Shasta, in California; and at the crossings of the Cascade and the Siskiyou mountains

This article describes the methods and equipment which the Southern Pacific has developed to combat the heavy snow storms that occur in the Sierra Nevada mountains in California. In these high mountains the normal annual snowfall ranges from 33 to 45 ft., so that there is often as much as 15 to 20 ft. on the ground at one time, and it is not uncommon for the total snowfall to reach 55 to 65 ft. during a single winter. Yet so effective are the organization and the methods employed that trains are rarely delayed.

in Oregon. The conditions through the Sierra Nevada mountains are the most severe and these and the snow-fighting methods employed on this line will be described in some detail.

From San Francisco, Cal., the Overland route to Ogden, Utah, extends east through Sacramento to Roseville, from which point it climbs for 85 miles to an elevation of 7,017 ft. at Norden, on a maximum gradient of 2.2 per cent and a maximum curvature of 10 deg. This line, which was built in 1869, was double tracked in 1925 and 1926, at which time color-light automatic signals were installed, and an intermittent-inductive automatic train-control system was installed between Emigrant Gap, 20 miles west, and Andover, 8.5 miles east, of the summit.

Heaviest Snowfall

East of the summit the heaviest grades lie between Norden and Truckee, 16 miles, in which section the alinement and grade do not differ materially from those on the west slope. However, while the heaviest snowfall occurs between Emigrant gap and Truckee, snow conditions are very bad all the way to Montello, Nev., 450 miles east of Truckee.

Practically all of the storms in the high Sierras come from the northwest. To keep as closely in touch with weather conditions as is possible, the Southern Pacific has placed barometers at the summit and at other strategic points on its lines and closely co-ordinates its own observations with those of the United States weather bureau. In this way it is generally possible to anticipate the arrival of snow from 12 to 24 hours.

As a rule, these storms are accompanied by relatively mild temperatures, from 15 to 30 deg. above zero, and without high winds. As has been mentioned, the snow sometimes falls at the rate of 1 ft. an hour, but the average is generally about 2 to 3 inches an hour. It is not unusual for a storm to continue without cessation for as long as 10 to 15 days. While the snow is usually slightly wet, occasional storms occur in which the snow is dry and is whipped by high winds into heavy drifts. Under the worst conditions it has been found helpful to abandon operation on the track nearest the mountain side and concentrate on keeping the other track open until the storm is over and an opportunity is given to start cleaning up.

At a number of places the slope of the mountain is very steep, making avalanches possible. The worst of these is on the westward track between Donner and Tunnel 6, on the east slope just below the summit. Here, the original line, now the westward track, clings to the side of Donner peak, with the steep rock face of the mountain rising more than 2,000 ft. above the track. Snow sheds of exceptionally heavy construction cover this track, except where it passes through seven tunnels, between these points. With the succession of winter storms, these sheds are often covered with snow to a depth of 80 ft. The eastward track passes through a two-mile tunnel between Norden and Donner, thus avoiding the severe snow conditions encountered by the other track.

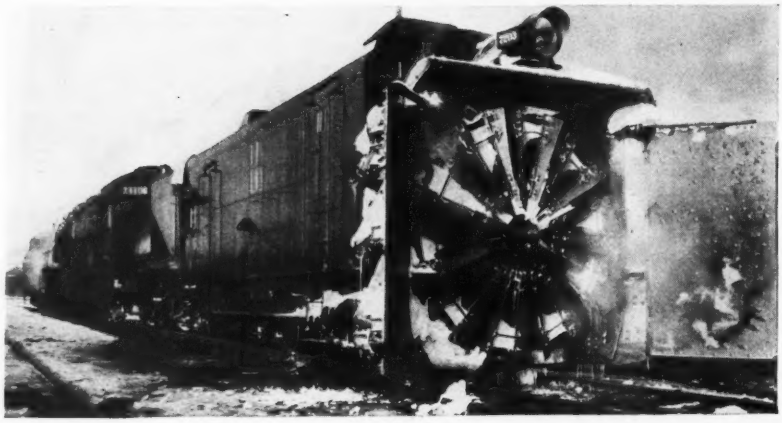
Preparations

As soon as the winter season is over, all snow-fighting equipment is given a detailed inspection and all necessary repairs and desirable alterations are made. Well in advance of the next winter, this equipment is assembled and the trained personnel is assigned to strategic points, ready to go into action at the first sign of snow. The heaviest equipment includes 7 flangers, 5 rotary plows and 2 spreaders. In addition, 50 locomotives operating in this territory are equipped with pilot plows.

Headquarters for the snow-fighting forces have been established at Norden, at the summit, and all operations are directed from here. Offices, as well as accommodations for eating and sleeping, are provided for the officers who direct the movement of the equipment. From this point telephone service extends to all points east and west, enabling those in charge to keep in constant touch with conditions on any part of the line. At Norden all tracks and a 120-ft. turntable are protected by snow sheds, and the fuel and water supplies are similarly protected.

At Emigrant Gap, 20 miles west of Norden, there is another covered turntable, for turning the snow

How the Line Looks After Cleaning-up Has Been Completed. One of the 4100 Class Cab-in-Front Locomotives.



Front End of One of the Wide-Wing Rotary Snow Plows.

equipment for the return movement to Norden after completing a run. Similar office, eating and sleeping accommodations have been provided at Emigrant Gap for the officers stationed at this point during the winter. A yard, an engine terminal and a balloon track for turning equipment are provided at Truckee, 16 miles east of Norden. Most of the snow-fighting units are held at this point, and here most of the crews begin and end their runs.

Roseville is the home station for all train and engine crews operating over the Sierras. Crews to operate the equipment, as well as relief crews, are called from here and are held at Truckee for their assignments during storms. This makes it necessary to estimate the requirements sufficiently in advance to permit the men to be brought up where they will be available when needed.

Provision must also be made for augmenting the section forces during prolonged storms, so that switches without snow-shed protection, of which there are many, can be kept clean. This work is done by hand, no switch heaters having yet been provided. As there is no local labor to draw on, these men must be brought up from the valley far enough in advance to be organized for the work they are to do.

When a storm is expected, the heaviest locomotives in use on this line are kept fired up in readiness to be coupled to the snow equipment. Train and engine crews and equipment operators respond at once to the call, which may come at any time of the day or night. The bridge, the building and the track forces, as well as the linemen and signal men, hold themselves in readiness to start without delay to their assignments. In other words, with the fall of the first snow flake the emergency is on.

Handling the First Snow

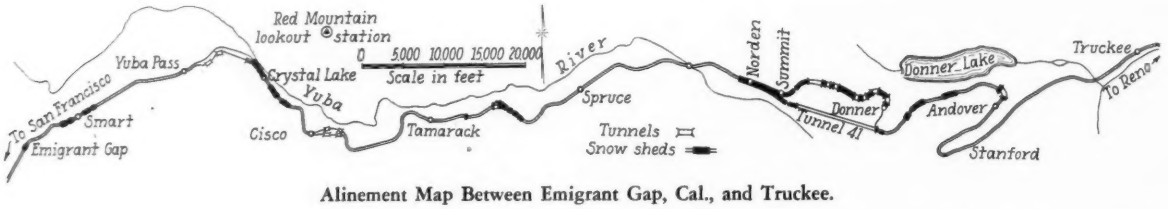
For a time, until the snow has been ridged up along the track so that they can no longer throw it out of the way, the pilot plows are used exclusively. When the pilot plows are no longer effective, the flangers are brought into play. Each flanger is fitted with two flare-shaped metal moldboards having cutting edges at the base. Those used exclusively in yard service have blades which extend the full width between the rails. On those for use on the main tracks, however, the flanger blades are installed in pairs, separated far enough to clear the track magnets of the automatic train control system, which are located in the center of the track. This is done to avoid the necessity for raising the blades when passing over the magnets, which cannot always be located with complete certainty from the moving equipment when the track is covered and the air is full of snow.

At road crossings and switches, the flanger blades are raised and lowered by air, the control being such that this can be done by either the engineman on the locomotive pulling the flanger or a member of the crew on the flanger. Each pair of blades is operated independently of the other, making it possible to operate one or both moldboards as desired, to throw the snow and ice to either or both sides of the track. This makes the operation flexible for use in double track territory, that is, where the two tracks are adjacent and parallel, at places where the tracks diverge and where the snow can be thrown to the downhill side of the canyon.

In the normal snow operations, the flangers are used more extensively than the other types of equipment. They are hauled by consolidation locomotives at a speed of about 30 miles an hour, and at this speed will throw the snow well clear of the track. They are very effective until the snow has reached a considerable depth, this depth depending in part on the moisture content of the snow and on how it packs as it falls. From the time they are called, the flangers are operated continuously until the snow ridges along the track have been built up so high that the moldboards will no longer throw the snow into the clear.

When this happens the rotary plows are called. These machines are the largest and most powerful of all of the snow-fighting equipment. They are not the ordinary rotary plows which are used elsewhere, but have been specially designed to withstand the severe service they must undergo in this section. When in operation they are pushed by 4100 class locomotives, the most powerful on the road.

Several designs, which represent stages in their development, are in use. The rotary fans vary in diameter from 9 ft. 11 in. to 11 ft. 2 in., but all are housed in hoods that can be raised and lowered. In ordinary operation, however, the hoods clear the rails 3 in. The fans are propelled by a steam power unit located in the rotary car, which is operated by an engineer and fireman, while a separate operator and an assistant ma-



Alinement Map Between Emigrant Gap, Cal., and Truckee.

nipulate the controls of the rotary.

As the rotary enters the snow the fans rotate at a high velocity, cutting through it and forcing it back into the cones. These, in turn, throw the snow through an opening in the top of the hood with sufficient force to deposit it far from the track or down the mountain side. During the period of a heavy storm, both the rotary plows and the flangers are kept in constant operation and one unit of each is required to precede every train when conditions demand.

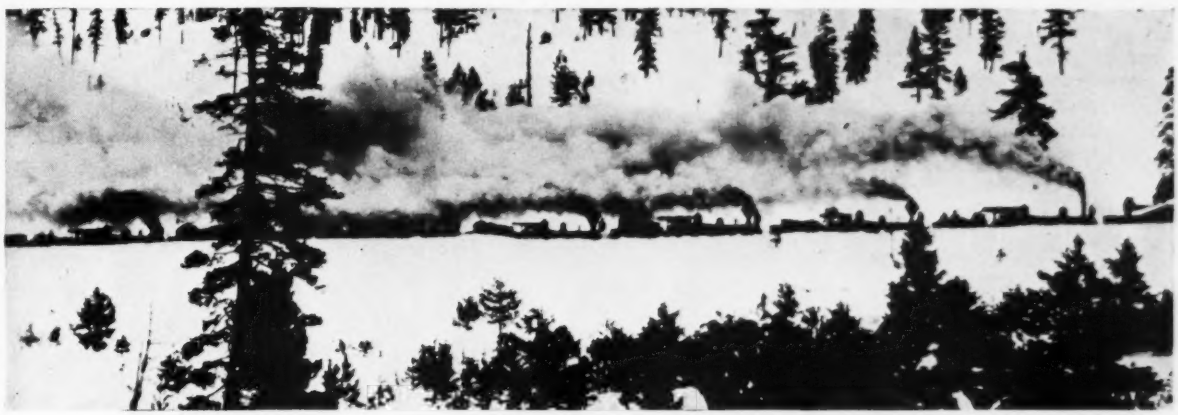
Immediately after the storm subsides the work of cleaning up begins. This is as important as that of keeping the line open during the storm and is attacked with the same vigor, for if it is not, another storm may arrive and the fight to keep the line open may be lost almost at the beginning. This operation consists of cleaning out the hard ridges between tracks and the packed snow outside of the tracks, which have been built up by the flangers or left by the rotary plows. The tracks are also cleared of all snow to a minimum width of 8.5 ft. from the center of the track. This operation includes the clearing of sidings and yards and shoving the snow down hill from the tracks wherever possible. To complete this task a spreader, a rotary plow and a wide-wing rotary plow make up the assembly for cleaning up the main tracks.

First, the spreader, with wings extended to 20 ft. on each side, is pushed along the outside track to clear a path 40 ft. wide in which the snow is leveled off even with the top of the rails on the opposite track and below the rail on the outside of the track over which it is being operated. Each of the wings is in three segments, and can be raised, lowered, extended or folded in at the will of the operator. These movements are made with air, the control valve being manipulated by the operator.

A spreader operator must be familiar with every obstruction on the territory over which he is to work, such as narrow cuts, rock projections, signal cases, switch stands and other objects coming within the 20 ft. spread of the wing. He must be exceptionally alert in locating them, for he often is required to work under the most adverse conditions, when they are buried under snow or obscured by darkness. Flanger signs on posts sufficiently high to reach above the snow are set wherever practicable, but some obstructions cannot be indicated in this way and the operator must know where to raise or fold in the wing, even though land marks are practically blotted out.

Substantially all of the line over the Sierras is on side hill. For this reason, the spreader is worked on the outside track, that is, on the canyon side, where the outer wing shoves the snow down the canyon slope. The inner wing, however, piles the snow on the other side on the opposite or hill-side track.

Following the spreader, the first rotary plow works on the inner track, removing the snow which has been shoved onto it by the spreader. The next step in the cleaning-up process is performed by the wide-wing rotary plow which follows immediately behind the first rotary. This plow is provided with hinged wings on each side, set just in front of the fan, which cut into the snow bank on the uphill side of the track to give four feet more clearance than is provided by the ordinary rotaries. This completes the cleaning up, so far as the main tracks are concerned.



How They Did It in the Old Days. Push Plow with a Battery of Wood-Burning Locomotives.

In the meantime, spreaders, locomotive cranes and crawler-mounted tractors equipped with bulldozers, have been at work removing the accumulation of snow in yards, at stations and elsewhere where snow-free areas are necesary.

Contrasting Early Methods

It is of interest to contrast present-day methods with those of the earlier period before the advent of the rotary plow, other snow equipment and the powerful locomotives which handle them. In that earlier day entire reliance was placed on push plows and an army of men with long-handled shovels. The push plow, the forerunner of the modern flanger, was placed in front of 6 to

Back of the Wing of a Spreader Engaged in Shoving Snow Down the Canyon During the Cleaning-up work.

12 of the small wood-burning locomotives then in use. This battery of locomotives then took a running start some distance back from the blockade and went into it with all throttles open. When the resistance brought this battering ram to a halt, the locomotives were backed out and the effort was repeated until a hole had been cut through the drift. Not infrequently the whole string of locomotives became stuck in the snow and had to be shoveled out before they could be moved, and sometimes one or more was derailed.

Under this method banks of snow were built up to a great height alongside the track, since the push plow threw it only a short distance, and there was no other equipment to reduce the accumulation. When the banks became too high, chambers or trenches were cut at intervals to provide a dumping place ahead of the plow. This, however, required a large force of men.

Section of Concrete Snow Shed in the Sierra Nevada Mountains. The Snow Sheds in This Section Have Been Reduced from 40 to 10 Miles.

Veterans on the Southern Pacific still relate the events of the winter of 1889-1890, when a Sierra storm piled the snow to a depth of 40 ft. on the level. During this storm, which blocked the road for 10 days, more than 5,000 men were employed near the summit. Luckily, equipment for cooking meals for this large number of men had already been provided, but it was necessary to bring provisions in by dog team until the line was open, no small task in itself.

About this time the Cyclone plow, resembling a large screw driver, was tried out without success. Later in the winter the first rotary plow was received, and stood the test, although by comparison with the modern machines of this type it was small and inefficient. Still later, what was known as the headlight plow was employed and continued in use until about 1916. This was attached to the front of the locomotive, with moldboards extending to about the top of the boiler and was capable of bucking drifts that were too deep for the ordinary pilot plow. It has given way, however, to the later designs of rotary plow and flanger.

Snow Sheds

No discussion of the snow problem in the Sierras would be complete without mentioning the snow sheds which for many years were the Southern Pacific's main reliance against the vagaries of winter in these mountains. The construction of the old Central Pacific, the name under which this line was built, was halted completely during the winters of 1866, 1867 and 1868, except for the underground work in the tunnels. The engineers who spent their winters in these mountains were quick to grasp the idea of snow sheds as the most practical means of keeping snow off the tracks in this exposed section of the mountains. Construction of these sheds was started in 1867, and their installation was extended until, in 1873, four years after this transcontinental line had been connected through, 40 miles of these sheds had been erected, extending in an almost unbroken stretch from Truckee to Blue Canyon.

As the efficiency of the snow-fighting equipment increased, the need for some of these sheds vanished, and several miles had been abandoned prior to the memorable storm during the winter of 1889-1890. When the line was double tracked between Colfax and Blue Canyon in 1913, the sheds in that district were abandoned, and by the time the double-track construction was resumed in 1925, slightly less than 30 miles remained. Since then a program of gradual abandonment has been carried out until today not more than 10 miles of sheds remain in the Sierra Nevada mountains and about one-half mile in the Cascades.

Since the program of gradual abandonment was adopted, the heaviest snowfall has been 661 in. or 55 ft., and there has been no serious delay as a result of snow, except in one or two instances where avalanches crushed certain sheds, mixing the timbers with the snow so that plows could not be used. In these cases, however, the delays occurred by reason of the difficulty of removing the timbers from the highly compacted snow by hand.

Maintaining the Sheds

Since the track and snow sheds are normally covered with snow from December to March, all of the work involved in maintaining the sheds must be done in the eight months of open weather. For this reason, at the close of winter the sheds are given a detailed inspection and the program for the summer is prepared on the basis of having it completed by December 1.

Fire is the greatest enemy of snow sheds. For this reason, as soon as the snow has melted from them, fire protection equipment, consisting of a locomotive and two 12,000-gal. water cars, is moved into position. One such train is stationed at Emigrant Gap and the other at Norden. The crews are subject to call during the 24 hours, and live adjacent to the train, which can get under way in five minutes after the alarm is received.

During this season, foot patrols are established day and night through the sheds. In the event of fire these patrolmen can notify the central station at Norden immediately by means of fire-alarm boxes which have been placed at short intervals through the sheds. As a further precaution, temporary fire breaks are cut at 500-ft. intervals in all sheds that are more than 700 ft. long. These openings are closed, however, before the arrival of snow.

Likewise, the roadway, the signal, the telephone and telegraph, the water service and the regular bridge and building forces get all of their work out of the way by December 1, each making certain that the structures and facilities under its charge are in shape for the winter's ordeal. In other words, the activities of the summer are all directed toward having everything ready for the four winter months when the track will be blanketed with deep snow, and all efforts will be directed toward keeping traffic moving in the face of seemingly insurmountable obstacles.

This View Is Typical of Conditions at Louisville During the Height of the Flood

Acme Photo

Worst Ohio River Flood Hits Railroads

Record high water in the Ohio river disrupted train schedules and caused extensive damage to railroad property during the last two weeks in January.

AS THE worst flood in the Ohio river in history began slowly to ebb during the last week, thereby exposing railroad tracks, structures and equipment that had been submerged for days, more than a dozen railroads whose lines penetrate the flood territory were beginning to get some idea of the task of rehabilitation that confronted them. A composite estimate of the extent of the damage is not yet available; however, hundreds of miles of main and yard tracks and many railroad structures, including important passenger and freight terminals, have been partially or totally submerged for days, some trackage has been washed out, devastating slides have occurred, and considerable railroad property has been destroyed by fire. Unquestionably the dollar value of the railroad damage will run into the millions. The immediate task at hand, however, is to restore train service to and through points in the flood area as rapidly as the receding waters permit.

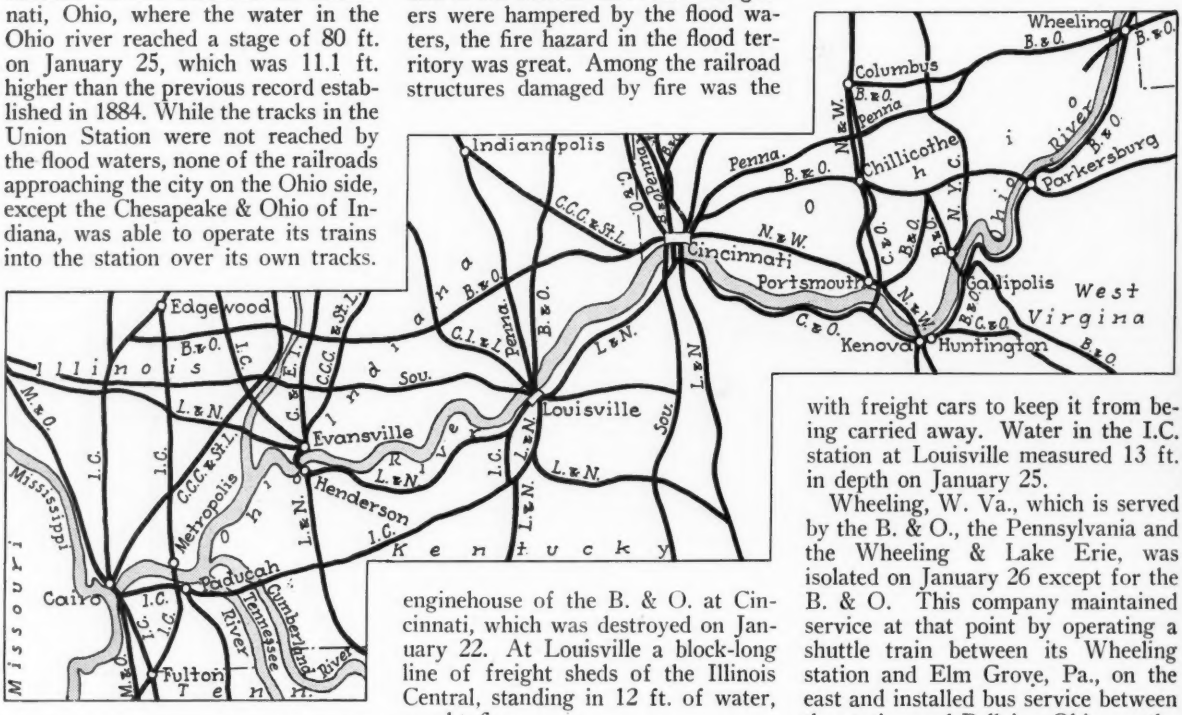
Fed by excessive rains which fell on half-frozen ground, the headwaters of the Ohio river and many of its tributaries reached flood stages about January 15 and continued to rise for another 12 days. As the crest of the flood moved downstream, high-water marks far in excess of all previous records were established successively at Wheeling, W. Va., Parkersburg, and Huntington, Portsmouth, Ohio, and Cincinnati, Louisville, Ky., Evansville, Ind., Paducah, Ky., and Cairo, Ill.

While no railroad bridges across the Ohio river were seriously damaged during the flood, the inundation of approaches or of connecting tracks rendered impassable most of these structures from Steubenville, Ohio, to the confluence of the Ohio and Mississippi rivers at Cairo, Ill., about 700 miles. In fact, so far as is known, the only bridge between these points over which trains were operated continuously during the high water was that of the Southern at Cincinnati. Because of this situation through trains to the south, except those that were able to use the Southern's bridge at Cincinnati, were either annulled or rerouted by way of Washington, D. C., on the east, or St. Louis, Mo., on the west. Moreover, because of the inundation or washing out of tracks, the flooding of terminal facilities and stations and the blocking of tracks by slides, local service in the flood area was badly disrupted or halted entirely.

Handicapped as they were, however, by the flood waters the railroads were unstinting in their efforts to ren-

der aid to the stricken areas by removing refugees to higher ground and by transporting food, pure water, supplies and volunteers to the flooded cities, in many cases donating their services without charge.

Probably the greatest disruption to railroad service occurred at Cincinnati, Ohio, where the water in the Ohio river reached a stage of 80 ft. on January 25, which was 11.1 ft. higher than the previous record established in 1884. While the tracks in the Union Station were not reached by the flood waters, none of the railroads approaching the city on the Ohio side, except the Chesapeake & Ohio of Indiana, was able to operate its trains into the station over its own tracks.



Showing the Important Lines Affected by the Flood

Owing to the high level of the water in the Ohio river west of the city, the Baltimore & Ohio line to St. Louis and the line to Chicago of the Cleveland, Cincinnati, Chicago & St. Louis (Big Four) were out of service, while backwater in the Mill Creek valley north of the Union station made the station inaccessible from the north and east by the B. & O., the Big Four, the Norfolk & Western and the Pennsylvania.

The Southern's bridge across the Ohio river by means of which this road gains access to Cincinnati from the south, remained in service and the Southern was able to operate its trains into the Union station over this bridge. However, service into the city over the Louisville & Nashville and the Chesapeake & Ohio, both of which approach Cincinnati from the Kentucky side, was at a standstill. The tracks of the L. & N. were covered with water at Worthville, Ky., and Eagle on the Cincinnati-Louisville line and at Falmouth, Ky., and Demossville on the Cincinnati-Paris line. As a consequence all service over this company's lines into Cincinnati was abandoned. Because of these conditions on both sides of the river at Cincinnati many trains were rerouted, while others were operated to suburban stations and the passengers transferred to buses.

Owing to the presence of inflammable liquids on the surface of the water at many points in the flood area and to the further fact that fire fighters were hampered by the flood waters, the fire hazard in the flood territory was great. Among the railroad structures damaged by fire was the enginehouse of the B. & O. at Cincinnati, which was destroyed on January 22. At Louisville a block-long line of freight sheds of the Illinois Central, standing in 12 ft. of water, caught fire.

Extensive damage was also caused to railroad facilities in the vicinity of Louisville. At this point most of the city was inundated when the water reached a stage of 57.1 ft., or 10 ft. higher than in 1884. Efforts to maintain regular service over the L. & N. into the city was abandoned on January 22, when the tracks and streets at its offices and the station at Tenth street and Broadway became submerged. The service of all other railroads entering Louisville was either greatly curtailed or halted altogether.

The property of the Illinois Central at Louisville was heavily damaged. In addition to the fire mentioned previously, a trestle carrying this company's lead to its freight house collapsed after it had been weighted with freight cars to keep it from being carried away. Water in the I.C. station at Louisville measured 13 ft. in depth on January 25.

Wheeling, W. Va., which is served by the B. & O., the Pennsylvania and the Wheeling & Lake Erie, was isolated on January 26 except for the B. & O. This company maintained service at that point by operating a shuttle train between its Wheeling station and Elm Grove, Pa., on the east and installed bus service between the station and Bellaire, Ohio, on the west. Points at which this company's lines were severed by the flood waters included Zanesville, Ohio, on the Muskingum river (Wheeling-Columbus line); at Bellaire on the Ohio; at numerous places between Wheeling and Kenova, W. Va.; at Chillicothe, Ohio, between Parkersburg, W. Va., and Cincinnati; and at points between Parkersburg and Clarksburg, W. Va.

At Huntington, W. Va., where the Ohio river reached a height of nearly

(Continued on page 110)

International Photo

The Bridge of the B. & O. Across the Miami River at Lawrenceburg, Ind., was Flooded

Santa Fe

End Hardens New Rails

As Standard Practice

One of the Heat Treating Machines in Operation

Convinced that the hardening of rail ends is justified by the savings produced, the Santa Fe has adopted the practice of heat treating in track the ends of all new rails by the oxy-acetylene process. During the last two years this company has end-hardened 550 miles of new rail and plans to treat 500 miles more in 1937. The process, the equipment used and the organization employed are described herein.

THE Atchison, Topeka & Santa Fe has adopted as standard practice the policy of heat treating in track the ends of all new rails. This decision was based on experiments conducted in 1934 which involved the heat-treating of the rail ends at 984 joints by the oxy-acetylene process. Observation of these joints, which involved comparison of the treated rail ends with untreated rail ends in adjacent track, convinced the railroad that the hardening of rail ends by this process results in the retarding of rail end batter. Thus substantial economies in rail joint maintenance are effected by reducing wear of the top surfaces of the angle bars and the under sides of the rail heads, by eliminating end flow and consequent chipping of the rail ends and by reducing the tendency to other undesirable conditions at joints, such as low joints and pumping joints.

Extent of Application

Following the experiments in 1934, the Santa Fe end hardened approximately 100 track miles of new 112-lb. rail in 1935 by the oxy-acetylene process. In 1936 all new rail laid, which included 429 track miles of 112-lb. rail and 23 miles of 90-lb. rail, comprising a total of about 120,000 joints, was subjected to the same process. This year it is planned to lay 5 miles of 131-lb. rail, 467 miles of 112-lb. rail and 28 miles of 90-lb. rail, a total of more than 500 track miles of new rail, all of which, in accordance with the railroad's new policy, will be end-hardened in track by the oxy-acetylene process. This will involve the heat-treating of approximately 135,000 joints.

The practice on the Santa Fe is to heat treat the new rails within a week or ten days after laying, during which time they have an opportunity to become properly seated. During the 1937 rail-laying program it is planned to have in operation four heat-treating gangs or one on each general manager's territory. These gangs will adhere to no definite schedule but will follow up the operations of the various division rail-laying gangs in accordance with instructions issued currently by the general managers of the respective regions.

Each of the gangs will be provided with one machine which heat-treats between 80 and 100 joints per hour of uninterrupted operation. Due to train interruptions the average output per eight-hour day of each machine is about 400 joints.

The Process

The rail-end heat treating process employed on the Santa Fe is that devised and perfected by The Oxweld Railroad Service Company. Employing a specially designed machine which utilizes six oxy-acetylene tips

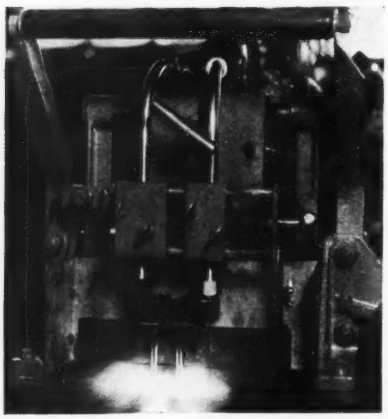
Illustrating the Type of Rail-End Grinding Equipment Employed on the Santa Fe in Connection with Its Rail-End Heat-Treating Work

as the heating agency, the surfaces of adjacent rail ends are heated to the critical point in about 18 sec. As soon as the flames are extinguished, a rapid transfer of a cooling action from the unheated balance of the rail to the heated area takes place and thus the desired hardness is produced, without use of oil, water or other quenching agency.

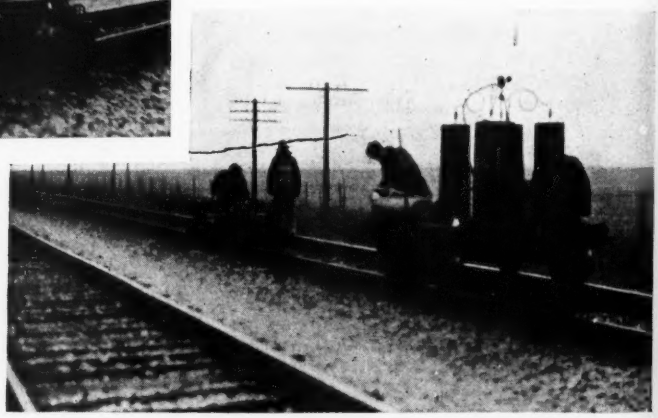
A feature of the process is that the rate of cooling is independent, for practical purposes, of atmospheric temperature, wind and other external influences, except rain, the results being controlled principally by the heat conductivity of the metal which is proportional to the difference between the temperatures of the hot and cold steel. Since the metal to be hardened must be heated to a temperature of approximately 1,550 deg. F., it makes little difference in the temperature gradient whether the temperature of the cold metal is 0 deg. F. or 100 deg. F. or higher.

By this process the treated portions of the rail end are given a hardness ranging between 350 and 400 Brinnell, although an effort is made to keep it between 350 and 375. In comparison, the hardness of untreated rail metal averages about 250. The heat-treated area at each rail end is about 1½ in. long on the outside of the rail head and about 2½ in. on the gage side. At the ends of the rails the effect of the hardening process extends to a depth of about ¼-in., which decreases gradually in proportion to the distance from the rail end, so that in longitudinal cross-section, the heat-treated metal is wedge-shaped.

The oxy-acetylene method of heat-treating rail ends, as applied on the Santa Fe, was first introduced by The Oxweld Railroad Service Company in 1933, following several years development and experimental work. While the principle underlying the method has remained unchanged since that time, the design of the heat-treating equipment has been in a continual state of development, improvements being made from time to time as they were suggested by experience with the heat-treating machines in the field.



Above — A Close-up View of One of the Heat-Treating Heads. Right — One of the Heat-Treating Machines in Operation Near Arkansas City, Kan. Extreme Right— Gas Cylinders Are Carried on a Push Car.



The Heating Machine

In its present state the machine is mounted on a tubular frame supported on four flanged wheels. Mounted transversely on this frame by means of rocker arms at each end, is a movable carriage, also of tubular construction, which carries a heat-treating head at each end, thus permitting joints in both rails to be treated with one machine without reversing its position on the track. Acetylene and oxygen cylinders are carried on a push car from which the gases are conveyed to connections on the machine through 50-ft. lengths of hose.

Valve levers for the control of the gases, as well as a lever for rocking the movable carriage back and forth in a lateral direction to secure oscillation of the heating flames, and, therefore a uniform distribution of heat on the surfaces of the rails, are located near the center of the machine where they are within convenient reach of the operator who is stationed directly behind the unit. Tubular handles attached to the frame in front of the operator's position facilitate the moving of the unit from joint to joint. Other handles are provided at each end of the machine for use in handling it to and from the track.

Heat Protection

To prevent damage of the heating tips by their own heat, a bronze baffle plate is suspended between the two outside tips in each heating head, on the one hand, and the four inside tips on the other. Members of the frame in the vicinity of the tips are protected from heat by means of a light-gage steel plate which encloses the tip blocks on three sides. To protect the operator from the heat, the frame of the unit is provided with a deck of light-gage sheet steel, while a hinged curtain of the same material, extending down nearly to the tops of the ties, is suspended from the lower rear member of the frame. The ties on the inside of the rail in the immediate vicinity of the joints are protected from damage by the heat by means of a piece of sheet steel about 24 in. square, which, being independent of the heat-treating machine, is moved from joint to joint as the work progresses.

Grinding of the Rail Ends

Preliminary to the heat-treating operation, the joints in the rail to be treated are cross-ground and surface ground. The latter operation has two objectives—removal of mill scale and rust from the surface of the metal and the grinding to a common

surface of rail ends that are of uneven height. Removal of the mill scale and other foreign material results in more thorough heat penetration and makes for more uniform hardness.

The equipment used in both the cross grinding and surface grinding work consists of rail grinders in which power is transmitted to the grinding attachment through a flexible shaft, the power plant mounting being of such design that it can be pushed along on the ground by one man wheel-barrow fashion or operated on rollers on one of the track rails with a stabilizing arm extending to the opposite rail. As both the grinding and rail end hardening equipment can be quickly removed from, and replaced on, the track, a minimum loss of productive time is occasioned to the work by the passage of trains.

Organization of Gangs

The grinding and heat-treating work on the Santa Fe have been carried out with two distinct types of organizations. Up to the end of 1936 the practice on the Eastern lines of the system was to employ the same machine operator, with one helper, as the nucleus of both the grinding and heat treating organizations, additional helpers being recruited as necessary from the section gangs. With this type of organization the gang would spend a day or so on grinding work and then drop back to heat-treat the joints that had been ground. Where the stretch of rail to be treated was of limited length—say, two miles or less—the practice was to grind all the joints before beginning the heat treating work.

When engaged in grinding joints, the machine operator and helper were augmented by one trackman who assisted in moving the equipment from joint to joint and in handling it on and off the track. When engaged in heat-treating joints, this organization required, in addition to the machine operator and helper, the services of four laborers to move the push car, handle cylinders and act as flagmen. Hereafter it is planned to dispense with this type of organization in favor of that which has been in vogue on the Western and Coast lines of the road.

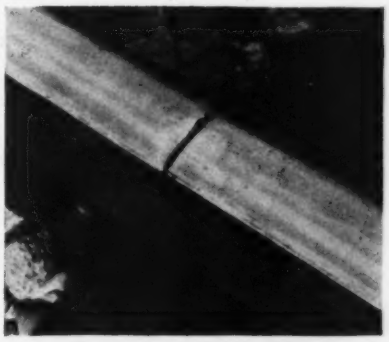
On those portions of the system the gangs have been so organized as to permit both phases of the grinding operation, as well as the heat-treating work, to be carried on simultaneously, with the cross-grinding unit in advance, the surface-grinding crew next, and the heat-treating gang in the rear. In this type of organization the entire gang, consisting of the cross and surface-grinding outfits and the heat-treating gangs, is in charge of a foreman who also acts as the operator of the heat-treating machine.

In addition to the foreman and his helper, this organization includes two grinder operators, two grinder helpers, and four laborers, a total of ten men. All of these men except the laborers, who are recruited from local section gangs, are permanent members of the heat-treating organization and are housed in outfit cars. These include, in addition to camp cars, a tool car, an equipment car, a gas-cylinder car and a water car. Other equipment includes a section motor car and a push car which, carrying a supply of gas cylinders, accompanies the heat-treating unit.

Another of the Heat - Treating Units. Notice the Metal Tie Protector.

The organization for the grinding work is simple, this operation being carried out by the two grinder operators and their helpers in the usual manner. In the heat-treating operation the operator, stationed directly behind the machine, manipulates the valves in the gas lines, and operates the oscillating lever. The heat-treating helper adjusts the tip blocks in the proper positions over the rail ends and also assists in moving the machine from joint to joint. One of the trackmen pushes the cylinder supply car along ahead of the heat-treating machine and another handles the metal tie protector, while the other two act as flagmen.

The gas supply carried on the push car is connected to the heat-treating machine by 50-ft. lengths of hose and usually consists of about five cylinders of acetylene, interconnected by a manifold, and one oxygen cylinder. Additional cylinders are distributed along the track at such intervals as to insure that the time lost in replacing empty cylinders with full cylinders on the push car is reduced to a minimum. The distribution of oxygen cylinders for this purpose is based on a consumption of oxygen amounting to about one cylinder for each 80 joints treated. As with the acetylene, it is frequently possible to carry a full day's supply on the push car, although if the crew should start out in the morning with partly depleted acetylene cylinders, it may become necessary to replenish the supply during the day.



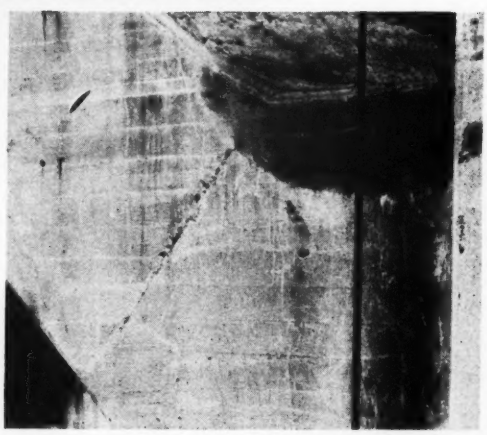
These Are Typical Heat-Treated Rail Ends. The Outline of the Heat-Treated Area Is Faintly Visible.

While the heat-treating operations are protected by flagmen, the foremen obtains a line-up of trains in the morning and another at noon, if possible, with the intention of having his equipment in the clear for all trains. The operation of removing the heat-treating machine from the track is simple and is quickly done, but the push car, being loaded with cylinders, requires more time. Only about a minute is required to remove both units from the track. Where possible the cylinder car is operated on an adjacent side track, in which event the problem of clearing the main track for trains is simplified.

The rail-end heat treating operations on the Santa Fe are under the supervision of G. W. Harris, chief engineer system. All the heat-treating equipment used, as well as technical supervision, is provided by The Oxweld Railroad Service Company.

Timely Repairs

A systematic concrete repair program, on which four special gangs are engaged, is now in progress on the Chicago, Burlington & Quincy. The scope of this program and the methods employed by the concrete repair gangs are described herein.



Above—Removing Defective Concrete from an Arch with an Air Hammer. Right—Showing a Patch Near the Spring Line of a Concrete Arch. Extreme Right—Illustrating a Type of Defect in Abutment Walls that Is Repaired by the Concrete Repair Gangs

BELIEVING that the best time to repair concrete is before the deterioration reaches an advanced stage, the Chicago, Burlington & Quincy is now in the midst of a concrete repair program that has as its objective the repair or patching of all defective concrete in bridges or other waterway openings on the road. This program is not only of interest because of its broad scope but also because of the practices that have been developed and are in use for insuring the durability and permanence of the concrete applied in the repair operations.

A considerable proportion of the mileage of the Burlington is located in an area where concrete structures are subject to the deteriorating effects of frost and chemical action. Moreover, many of the concrete structures on this road were constructed during a period when the knowledge of concrete manufacture and placement was not as advanced as it is today and when the tendency was to use too much water in the mixes. In addition, sound aggregates were not always available and it was necessary in some instances to select aggregates of uncertain quality. While the defects that have developed in the concrete as a result of these factors have not been serious and, as a rule, have affected only the appearance of the structures, the railroad recognized that they are of a progressive nature and that the affected areas will gradually become larger with the passage of time. These considerations led to a decision about five years ago to undertake the repair of defective concrete to improve the appearance of the structures and to halt further deterioration.

Prior to 1931 the masonry repair forces on the Burlington consisted of a single system gang which confined its activities to the pointing of stone masonry, such concrete repairs as were necessary being done by private contractors or by division forces. However, coincident with the inauguration of the concrete repair program in that year, two gangs were placed in the field to specialize in the repair of concrete masonry, and the masonry-pointing gang was also put to work on concrete structures. About three years ago still another gang was added to the concrete repair forces so that at present four crews are engaged in this work on various divisions during the working season.

During the 1936 season two of the gangs were engaged on the La Crosse

Save Concrete

on the Burlington

division and one each on the Hannibal and Aurora divisions. On the La Crosse division, which follows the east bank of the Mississippi river between Savanna, Ill., and St. Paul, Minn., a distance of nearly 300 miles, the depth of the water at many bridges will be increased and the flooding of others that are now normally dry will result when the water in the river is impounded behind a series of dams which the federal government now has under construction. To avoid the additional cost and difficulty that would be entailed in making repairs to concrete masonry that will be submerged, the railroad put the two gangs to work on this division in an effort to complete the necessary repairs before the dams across the river are finished and higher water stages established.

During the winter months three of the concrete repair gangs are disbanded. The fourth is kept in service the year around and during the winter is engaged for the most part on the repair and pointing of stone masonry structures. Work on culverts and arches is made possible during the coldest weather by closing the ends with canvas tarpaulins and heating the interiors with stoves and the water and aggregates for the concrete with salamanders.

Operations Are Out-of-Face

Generally speaking, the concrete repair gangs make all necessary repairs as they proceed, taking up their work in the spring where they ceased operations the preceding fall. On the La Crosse division, however, where the special conditions obtain, the procedure is to start the repair work on the structure nearest the dam site and work upstream, the object being to repair as soon as possible those structures that are situated where the rise in the river level will be the greatest and where the maximum effects of the higher water will be experienced. The operations of the masonry repair gangs are programmed in accordance with the annual bridge inspections. As a rule responsibility for determining what repairs are to be made is placed on the gang foremen, with occasional supervision by the local bridge and building supervisor or by representatives from the bridge engineer's office.

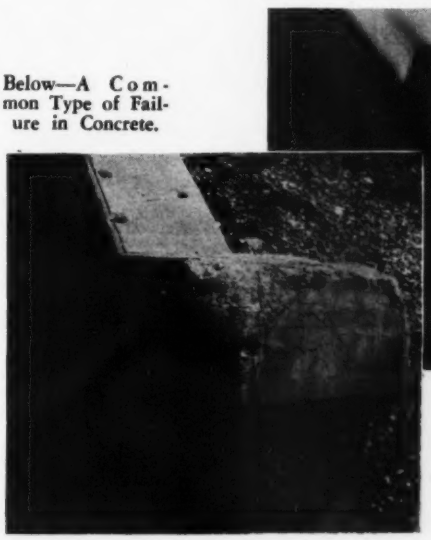
These concrete-repair gangs are fairly well standardized as to personnel, equipment and methods. Each gang includes two masons, a mason helper and a laborer, in addition to the foreman. Pneumatic equipment provided for each gang includes an air compressor, generally with a capacity of 250 cu. ft. per min.; a demolition hammer or pavement breaker for loosening the defective concrete where relatively large quantities are to be removed; two small chipping hammers which are used for removing concrete in locations where the larger tool cannot conveniently be used and also for finishing the bottoms and sides of the cavities; and a drill for boring holes for dowels and reinforcing steel. Other equipment includes a portable pump, materials and tools necessary for the erection of staging, blocks and tackle, jacks, etc. A small-batch mixer is provided for mixing concrete. The gangs are housed in camp-car outfits, each of which comprises a foreman's car, a bunk car, a kitchen and dining car and a tool car.

Patches are applied to concrete wherever an appreciable amount of cracking, chipping or spalling has occurred. In making the patches special care is taken to remove all defective concrete, the extent of the affected area being ascertained by tapping the concrete with a hammer and noting the variations in the tones produced. To insure a good bond between the new and old concrete, dowels of expansion bolts are used liberally. Additional reinforcing is inserted wherever it is considered necessary, the practice being, wherever possible, to insert the ends of the bars in holes drilled in opposite sides of the cavity to be filled. To avoid feather edges on the patches the sides of cavities are made at least 1 in. deep and are also undercut slightly to form a "dovetail" joint with the new concrete.

By means of metallic waterproofing the surfaces of the concrete in the cavities as well as the surface of the newly-applied concrete are thoroughly waterproofed, and, through the use of a non-shrink admixture, shrinkage of the concrete in the patches is counteracted, particularly where there is evidence of water seepage.

Typical Procedure

Because of the wide variation in the size, shape and location of the patches and the conditions under which they are made, only a general



Below—A Common Type of Failure in Concrete.

Above—Wall Coping Shown at the Left After the Defective Concrete Had Been Removed and Expansion Bolts Inserted.

description can be given of the procedure that is followed in making them. In general, however, after all the defective concrete has been removed and the cavity has been given the desired shape and size, the holes are drilled for the expansion bolts and the additional reinforcing, if any is to be inserted. The metallic waterproofing, which is in powder form and is mixed with water for application, is then applied with brushes over the bottoms and sides of the cavity and is kept in a moist condition for about 24 hours to secure complete oxidation.

The next step is to cut and place the expansion bolts and reinforcing steel. The expansion bolts used are generally ¼ in. in diameter and are formed with a 2-in. hook at the outer end, while the reinforcing, if any, consists of ⅜-in. or ½-in. round bars. The number of expansion bolts and the amount of reinforcing to be used are left to the judgment of the concrete repair foreman.

These Illustrations Show the Extent to which Defective Concrete Is Removed Before the New Concrete Is Placed.

Use of Forms

Except where the patches are small or narrow, such as at cracks, it is generally necessary to use forms. In the case of the smaller patches, the boards in the forms are held in place by wiring them to the expansion bolts but where the quantity of concrete to be held in place is considerable, the forms are bolted to ½-in. expansion bolts that are embedded in the concrete for this purpose.

For patches of large and medium size the concrete is mixed in the proportion by volume of one part of cement to four of sand and gravel, the latter having a maximum size of ⅜-in. or ¾-in. depending on the class of work. In some cases, where the patches are located on a flat surface and surrounded on all sides by sound concrete, the form is filled with the plain mix to within about ½ in. of the upper edge of the patch, the remaining space being filled with a mix containing a non-shrink admixture for the purpose of counteracting the shrinkage in the entire patch.

Narrow Patches

For small or narrow patches (2 in. to 4 in. wide) no coarse aggregate is used and the mix consists of one part of cement to two of screened sand. At cracks where there is evidence of water seepage and it is desired to make the patch as tight as possible, the non-shrink admixture is used in the mix in the proportion of one part of the admixture, two of cement and three of screened sand. A further precaution taken at such locations is to find the source of the water and bypass it, by means of pipe drains, around the affected area in the concrete.

The patches are kept in a moistened condition until the concrete has attained its initial set, after which a slush coat is applied to the surface of the patch and the surrounding concrete, which consists of one part of metallic waterproofing, two parts of cement and one of sand. To secure thorough oxidation of the waterproofing compound and thereby maximum resistance to the entrance of water, this slush coat is kept wet for a day or more. The final step in the construction of a patch is the application of another slush coat, consisting of one part of cement and two of sand, about a week after the placing of the concrete.

While the procedure described above is followed in the majority of instances, conditions are frequently encountered which require special treatment. For instance, in a highway bridge consisting of concrete beams carried on concrete piers, which crosses the railroad's line at Polo, Mo., a large chunk of concrete had become loosened from the coping of one of the piers. The coping in question was 1 ft. 6 in. thick and 3 ft. 6 in. by 31 ft. 4 in. in plan and had rounded corners. In addition to repairing the coping in the usual manner, it was decided to protect it against further damage of this character by the application of a tightly-fitting jacket of ½-in. steel plates. In carrying out this plan a plate, 18 in. wide and almost as long as the pier, the ends of which were curved to conform to the curvature of the coping, was placed against the coping on each side of the pier, the two plates being held in place by 1-in. bolts on 15-in. centers extending entirely through the coping.

Certain of the practices followed on the Burlington in the repair of stone masonry culverts and arches are also worthy of comment. In some instances it is found necessary to reinforce such structures by the application of a jacket or casing of concrete on the interiors, and in such cases a check of the size of the existing waterway opening is made to determine its adequacy to carry the run-off of the drainage area. If it is found that the opening is more than sufficient for the location and will bear some reduction, the concrete is applied directly over the old stone, only defective portions of the latter being removed. Where the waterway opening shows no excess area it is necessary to remove sufficient of the stone to compensate for the thickness of the concrete that is applied.

One of the practices that has been developed in the repair of such structures involves the use of ½-in. boat spikes for holding the reinforcing in place, the spikes being driven into the

joints between the stones and the heads clinched over the reinforcing bars. To prepare the spikes for this purpose, they are heated to a forging temperature and flattened somewhat to facilitate driving. To render them more malleable they are allowed to cool slowly.

An interesting innovation, involving the use of clamps of a special design, is employed in the repair of stone masonry piers in which the stones in the top course have shown a tendency to spread apart under the weight of the superstructure. The clamps used are formed of 1-in. by 4-in. steel bars about 28 in. long. A 5-in. right-angle bend is made at each end of each bar and the bent portions or legs are given an inward or concave curve. When the two legs of a bar are driven into holes drilled in adjacent stones in the top of the pier the springing action induced by the curvature tends to draw the stones together. The horizontal portions of the clamps are inserted in grooves cut in the masonry so that the upper edges are flush with the top surface of the pier.

Since the concrete repair program described in this article was inaugurated the patching of such structures on about 700 miles of line has been completed, and as the repair forces have gained experience and skill in the application of patches, the railroad has become even more fully convinced of the soundness of the policy of repairing concrete before deterioration has been allowed to progress beyond the initial stage.

The concrete repair program on the Burlington is being carried out under the general supervision of G. A. Haggander, engineer of bridges.

"Don't Let It Occur to You"

FROM 22.9 to 27.4 per cent of all railway employees killed while on duty during the last 15 years lost their lives as a result of being struck or run over by locomotives or cars. For this reason the Committee on Education of the Safety section of the Association of American Railroads has issued at least three circulars in each of the last five years dealing with this serious menace to railway men. The effectiveness of these appeals is indicated by the fact that deaths from this one cause were reduced from 1,578 in the five years ending with December 31, 1931, to 628 for the following five years, and by the fact that fatalities from this cause represented 22.9 per cent of the total fatalities for the last five years, compared with 27.9 per cent for the five years ending with December 31, 1931.

As a means of continuing its education work on this subject the committee has issued circular, No. S-517, that drives home the hazard of "walking, standing or sitting on the track" and is distributing the poster reproduced on this page. The bulletin reads as follows:

DON'T LET IT OCCUR TO YOU

Walking, standing or sitting on tracks except when necessary in the performance of duty is prohibited. This is a good rule to follow in our efforts to prevent men from being killed or permanently injured by being "STRUCK OR RUN OVER BY LOCOMOTIVES OR CARS."

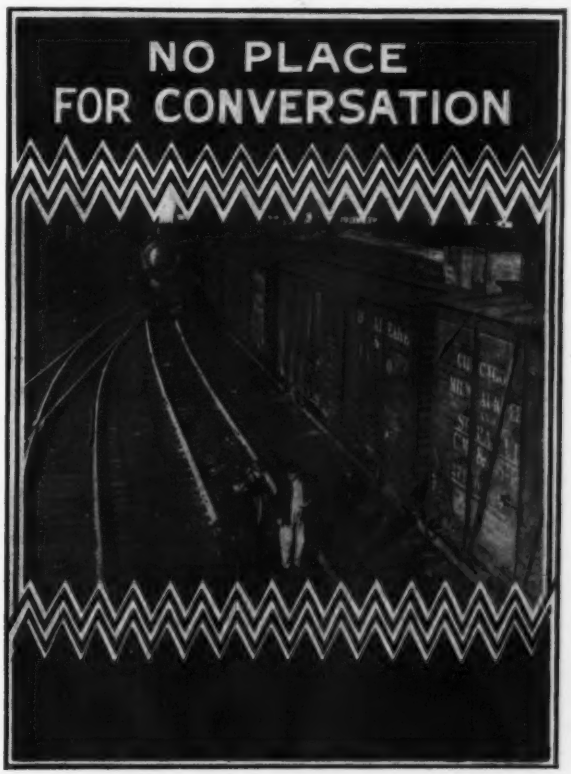
Some railroads enforce this as a definite safety rule, while others are seeking its application through education, warnings, reminders, etc. By whatever means the effort is made it is a long step in the right direction, for this class of accidents accounts for nearly one-fourth of all employee fatalities and at least 80 per cent of the cases of "Struck or Runover," result in death or permanent disability.

It is said that we must learn from the horrifying experiences of others, but it is better to learn that way than not at all, so, with the hope that many now living and unhurt may remain so, a few cases are here related in which the victims forgot their own safety.

A young track foreman was supervising work being performed by two laborers. It was snowing hard and a movement of time freight was soon to be made. The foreman became dissatisfied with the manner in which one of the laborers was doing his work, and taking the tool from him he undertook the job himself, squatting down between the rails. He was killed by a yard engine within five minutes. There is no quarrel with the foreman for demonstrating to a laborer the correct method of work. We might even overlook his having taken on a laborer's job temporarily, if the emergency warranted. We cannot condone his act in making a laborer of himself without delegating to a member of his force that part of a foreman's duty requiring him to safeguard his men.

A traveling inspector from the general offices was walking between the

(Continued on page 110)



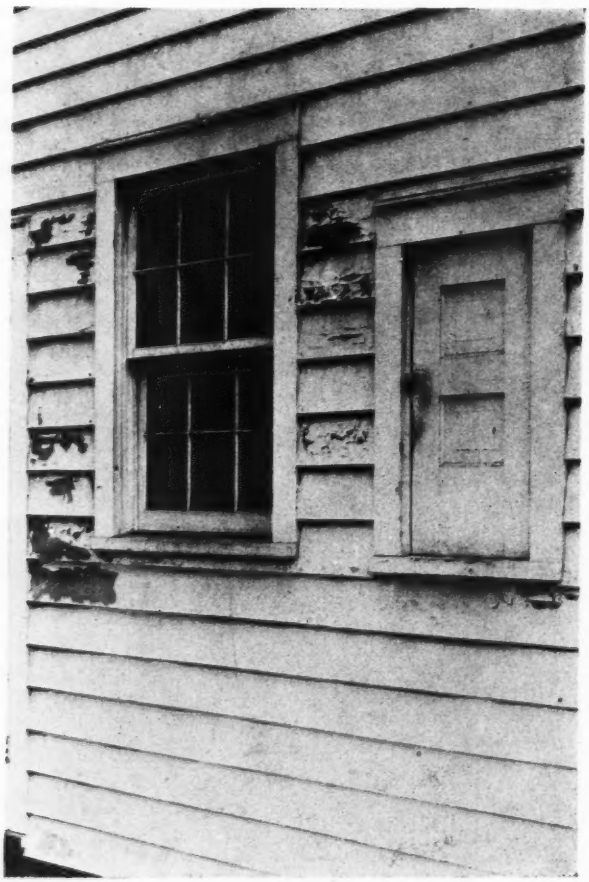
The Safety Poster for February

Painting P

Developments in paint composition in recent years have tended to complicate problems involved in the painting of both old and new structures. Important among these problems is that presented by the "incompatibility" of different paints, which is dealt with at length in this discussion. Thickness of paint coats, frequency of painting and new developments in paint formulation are other matters that are given attention.

By F. L. BROWNE

Senior Chemist, U. S. Forest Products Laboratory, Madison, Wis.



Outcome of an Unplanned Paint Maintenance Program

First painting with two coats of white paint, second painting with dark brown paint, and third painting with two coats of white paint. Photographed 18 months after last painting. Definite result of incompatibility.

THE past decade or two marks a period of accelerating changes in paint formulation, the end of which is not yet in sight. Many of the changes in paints have been in the direction of furnishing distinctly improved products from the user's point of view. The same period of time, however, has marked also an increasing feeling of exasperation with the uncertainties of paint behavior and with the numerous cases of unreasonably early failures of paint jobs.

The dominant factor that has been so generally overlooked in the past is the fact that a good paint, if it is to give the good service of which it is capable, must be used in a program of paint maintenance for which it is suitable and for which it was designed. Most painting takes the form of renewing a coating applied some years previously; the composition of the new coating and the behavior to be expected of it depend upon the composition and age of the paint or paints used previously as well as upon the composition of the new paint.

What Is Good Paint?

If a building stands 50 years it receives one paint job when erected and, if well maintained, some 10 or 12 paint jobs at suitable intervals subsequently. Each repaint job is applied over what is left of the preceding jobs; if it becomes necessary at any time to remove the old coating the maintenance program has been unsatisfactory at least for that building. To the paint purchaser, therefore, the important point is not whether a given paint is capable of good service, but whether it can be relied upon to give good service on the particular building for which it is purchased. A good paint for one building may be bad paint for the one next door.

Failure to recognize that, after the initial paint job, a coating is com-

*Abstract of a paper presented before the convention of the American Railway Bridge and Building Association on October 21.

Problems—
What Are They Today?*

posed of the old paint plus the new paint is largely responsible for the failure of recent developments in paint formulation to effect an improvement in the general serviceableness of paint. Each new paint formula brought out adds one more to the already super-abundant types of paint on the market, for the new products never succeed in displacing the old. With paint users generally making little effort to follow consistent programs of maintenance this means that with every new paint the chances of incompatible combinations of paint are increased and the number of abnormally early paint failures becomes greater. On the other hand some of the new paints offer distinct advantages for those who learn how to work them into their maintenance programs safely.

Haphazard programs of paint maintenance so often lead sooner or later to disaster even though high grade paints are always used because one or more of three principal blunders are made: (1) Incompatible combinations of paints are used either in the same paint job or in successive paint jobs; (2) either too much or too little paint is applied at a time, (3) either too much or too little time is allowed to elapse between paintings. To these three basic causes of difficulty with good paints must be added a fourth with which it is often very difficult to deal, namely, access of water to the backs of painted boards, causing blistering and subsequent scaling of the coating at an early age.

Incompatible Combinations

For a long time much emphasis has been placed on the fact that paints last longer on some woods than on others but very little has been said about the even greater variation in behavior when paint of any one kind is applied over paints of other kinds. We know certain combinations of paints that commonly lead to difficulties but we do not know yet just how far two paints may differ and still work reasonably well together. For the present, therefore, the paint user should take the conservative position of considering any serious change in type of paint in the make-up of a coating too dangerous unless there is good evidence in past experience that the particular combination under consideration can be expected to give good service.

A very common incompatibility results from the application of a white or tinted white paint over a colored paint made with little or no lead or zinc pigments. For example, during a 2,000-mile journey over a certain railroad a few years ago the cracking and slipping of a bright yellow paint over red iron oxide paint could be observed from the Pullman car at nearly every station. Early failures of white paints over greens, browns, and blacks are likewise to be seen frequently.

Incompatibilities likewise arise among white paints when they are made with very different combinations of white pigments. It has long been held that white lead and zinc oxide, unlike the remaining white and transparent pigments, are chemically active and profoundly modify the linoxyn formed from linseed oil. Zinc oxide particularly has a definite hardening action on paint, the effect being roughly proportional to the amount of zinc oxide in the total pigment. At any rate, variation in the zinc oxide content of paints causes very distinct changes in the physical properties of the paint. It seems to be advisable to keep the zinc oxide content of paints used successively as nearly constant as practicable. When pure white lead paint, for example, is applied over a previous coating of paint that

An Excellent Example of Incompatibility

Failure of a tinted white paint applied on a building that for years previously had been kept painted with paints of dark color in which there would be no lead or zinc pigments.

contains zinc oxide, especially if the previous paint has not weathered for a long time, early failure of the white lead paint by conspicuous alligatoring is often observed.

To what extent the proportions of white lead and of chemically inert pigments in successive paint coats affect the durability of paint jobs is not yet known. A number of cases have been observed, however, in which paints of the newer pigmentations involving titanium or zinc sulfide pigments, when applied over older paints of the lead and zinc type, have failed to give the service such paints have demonstrated in consistent programs of paint maintenance. Until more is known about the compatibilities of paints prudence suggests the practice of repainting always with much the same kind of paint used previously.

The proportion of total pigment to non-volatile liquids in paint is significant from the point of view of compatibility. In the formulation of the newer paints it is being generally recognized that in a finish coat of white paint the total pigments should amount to roughly 27 to 30 per cent by volume of the total non-volatile matter instead of the 20 to 25 per cent and even lower that was characteristic of the older formulations. The undercoat, however, should never have less pigment than the finish coat and best practice requires that it have more. For that reason a painter, by thinning the undercoat with too much oil can produce an incompatibility, even when working with the same paint.

Thickness of Paint Coats

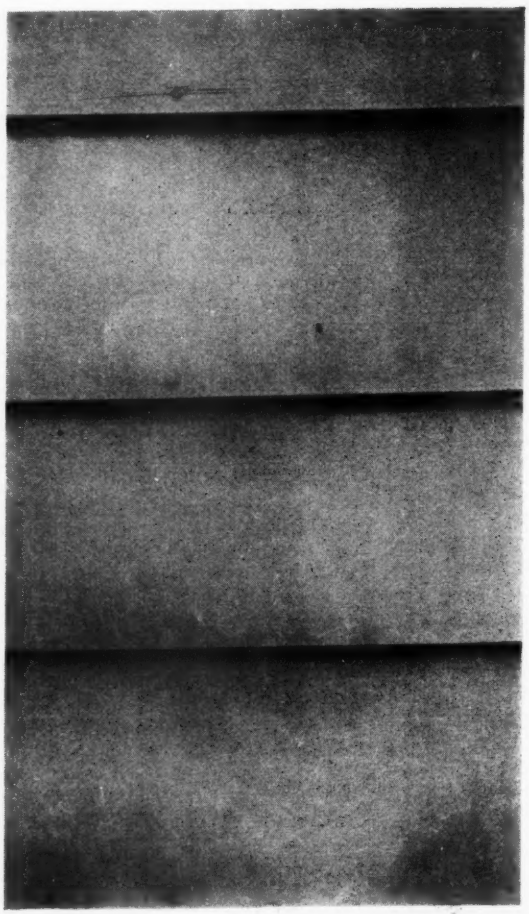
There seems to be an optimum range of thickness of paint coatings for optimum service. An initial coating of white lead paint applied to new wood according to customary recommendations is about 0.005 inch in thickness while initial jobs of harder paints are often nearer 0.004 inch. Thinner coatings of each type of paint, whether they hide the surface satisfactorily or not, are less durable and more liable to difficulty with spotted chalking and fading. On the other hand thicker coatings, especially with the harder paints, not only prove no more durable but are prone to more conspicuous cracking, curling and flaking.

In a good program of maintenance the amount of paint restored at each repainting does not greatly exceed the amount worn away since the previous painting so that the thickness of the coating can be kept within the region of optimum serviceableness. Where the coating is allowed to become very thick in the course of time objectionable forms of paint failure are observed that are never seen with thinner coatings of the same paints, and the surface becomes more and more difficult to repaint acceptably.

Frequency and Quantity

The more frequently a surface is painted the less paint should be put on at a time. For a given interval between paintings the harder the paint used the less should be put on at a time. Fortunately the harder paints, after weathering, are less absorptive and "hold out" new paint more easily than softer paints. Since different parts of a building usually receive different degrees of exposure to sunshine some parts need more paint than others at each repainting. For these reasons it is impracticable to make general statements about the amount of paint that should be applied in repainting.

It may be said, however, that there is a general tendency to use too much paint in repainting when paints of the harder types are used. This tendency is likely to be particularly pronounced in the maintenance of the property of large corporations where it is desired to impress the public favorably. Where good appearance in a necessarily sooty environment is desired it is often better to use hard paints of high opacity that wash satisfactorily, washing them once or twice between paintings, and washing and repainting them with one coat at reasonable intervals rather than repainting them at short intervals with two thick coats at a time. With moderately hard paints, one good coat of paint applied about every four years is ordinarily sufficient on woodwork.



An Example of a Well Planned Paint Program

First painting in 1924 with two coats of white lead paint. Repainted with one coat of a harder paint of the modern titanium pigment type in 1927, 1931, and 1935. Photograph taken just before last painting shows a surface that is chalking freely but is free from checking, cracking, curling, flaking, or scaling.

Much trouble with paint comes from failure to observe any systematic plan of repainting. Except with paints that stand neglect well, repainting should anticipate rather than follow break-up of the coating. Where repainting is done before the coating cracks, curls, and flakes in patches there is no problem of scraping off all loosened paint and a smooth, sound foundation for the new layer of paint is assured. The renewed coating, therefore, may be expected to have normal durability. The economical course in the long run is to adopt a planned program

of maintenance when the building is erected, select a type of paint suitable for the program, and then adhere firmly to the program.

The old custom of using red iron oxide paints for the maintenance of buildings of strictly utilitarian purpose still has much to commend it. Good paint of that type is exceedingly durable and stands neglect well. For those reasons colored pigment paints like iron oxide paints are particularly appropriate for maintenance programs with long intervals between paintings or for buildings for which it proves impracticable to adopt a definite program. In times of financial depression maintenance painting is usually curtailed and it may be wise to recognize that some buildings at times will be neglected.

Aluminum Paint

Aluminum paint is beginning to find use as a complete coating for wood for programs with long intervals between paintings. From the point of view of maintaining protection for an unusually long time it is superior to iron oxide paints and its appearance, although metallic, is brighter and more cheerful than the dull red of iron oxide.

Among white paints and tinted paints based on white paints, only formulations that make very soft paints are capable of standing neglect well. Pure white lead paint is the best known very soft paint. It disintegrates by deep chalking, fine checking, and fine crumbling and it wears away by erosion fairly rapidly but, in consistent maintenance programs, it does not crack, curl, or flake. While not an outstandingly durable white paint it is one of the very few white paints that can safely be allowed to pass through periods of neglect and still leave a surface that can be repainted easily and with assurance of normal durability. For maintenance of railroad property, however, soft paints have the serious disadvantage of collecting dirt badly and being somewhat difficult to wash satisfactorily. Harder types of white and tinted paints are therefore preferred, but in using them it should be remembered that they cannot safely be neglected and should be maintained strictly in accordance with a conservatively planned program.

In the writer's opinion the outstanding development in exterior paints in recent years is the increasing diversity in types of paint on the market and the consequent necessity for greater technical knowledge of paint composition and its significance in paint maintenance programs on the part of the paint user. Inasmuch as it is rarely practicable to place the maintenance program completely in charge of a single paint manufacturer, the paint user must assume far more technical responsibility than he is often prepared to handle intelligently.

Combinations of Pigments

The dominant trend in the manufacture of first grade white paints in recent years has been in the direction of combinations of titanium pigments, white lead, and zinc oxide. The trend is less marked in tinted white paints because the very opaque chalk characteristic of titanium dioxide gives rise to marked fading. The disadvantage of fading, however, should be weighed against the advantage of greater freedom from dirt which is likewise characteristic of titanium formulations. In many tints a fairly clean surface even though somewhat faded, is superior in appearance to a dirty surface. With white paint, fading does not enter into the picture and greater cleanliness is a clear advantage.

Most of the titanium formulations are further characterized by a lower content of zinc oxide and a higher content of total pigment than was customary in lead and zinc formulations of similar grade. As a result these paints, when used in consistent programs of maintenance and properly applied, remain free from checking or cracking for a long time. On the whole the writer feels that the typical titanium formulations are somewhat less dangerous than the older lead and zinc formulations if for any reason repainting is deferred a trifle too long, but they cannot safely be allowed to go through long periods of neglect. Good titanium pigment paints have much greater opacity than older paints and are therefore especially useful in maintenance programs with relatively short intervals between repaintings, in which the least possible amount of paint should be applied at a time.

Lead titanate is a very new paint pigment that may become important in the future. It is not quite white, having a trace of yellow color, and for that reason the amount that can be used in a white paint is limited but a large proportion can be used in many tinted paints. The information available so far indicates that lead titanate has a remarkable tendency to retard the embrittlement of paint with age. If it proves possible to take adequate advantage of that property, white and tinted paints may be made more durable in the future.

Soy Bean Oil

In recent years many efforts have been made to replace the linseed oil in house paint wholly or in large part with other drying oils or resins. Soy bean oil is much discussed at the present time. While not so good a drying oil as linseed, very substantial proportions of soy bean oil can be incorporated in good paint, especially if fortified with superior drying oils like perilla or with a small amount of properly treated tung oil. The use of soy bean oil, however, is chiefly a question of utilization of domestic farm crops; there is no immediate prospect of obtaining definitely improved paints in that way.

Some consideration is being given to the possible use of moderate proportions of resin in the vehicle of paints in which there is no zinc oxide in the pigment, the resin being used to impart the desired degree of hardness instead of zinc oxide. Whether such a radical shift in traditional formulation offers any material advantage remains for the future to disclose.

A typcial stretch of track on the Western Lines of the Atchison, Topeka & Santa Fe.

The Lake Pontchartrain Trestle

By W. B. GREGORY

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Built in 1882 of creosoted yellow-pine timber, this structure is still carrying all trains of the Southern and the Gulf, Mobile & Northern railways into New Orleans. Although strengthened at various times to accommodate heavier loading, much of the original timber is still in use after 53 years service. The history and present status of this historic structure were presented at the thirty-third annual convention of the American Wood-Preservers Association at New Orleans on January 27.

THE Lake Pontchartrain trestle, 5.82 miles long, carries the Southern into New Orleans. Construction was started in February, 1882, and finished in September of that year. It was built of creosoted yellow-pine timber. Piles from 50 to 68 ft. long, below cut-off, were driven. The total penetration varied from 40 to 48 ft., according to the length of the piles and the depth of water, which is from 8 to 10 ft. The piles were cut off to support caps 12 in. by 44 in., laid flat; above the caps are the stringers on which the crossties and decking rest. When first built, the crossties were supported by six stringers, 6 in. by 16 in. in cross-section by 30 ft. long. Originally the bents were 15 ft. apart.

The deck of the trestle is protected by a covering of gravel, the use of which was commenced in 1885 after fire had seriously damaged or destroyed about 325 panels to the water line.

In 1928, after almost 45 years service, there remained intact 574 of the original pile bents out of a total of 2,010, or approximately 28.5 per cent. In 322 other bents, half the piles had been cut off just above the water line and half-framed bents erected. In 1,114 other bents the original four piles had been cut off just above the water line and four-post framed bents erected. All of the original ties had been renewed, almost entirely as a result of mechanical damage by reason of creeping rail and the thin tie plates used originally. Of the original stringers, only 194 had been renewed on this date. The renewal of piles above the water line had been made necessary almost entirely as a result of decay of heart timber, where they were cut off for the placing of the caps.

In connection with the Southern's bridge renewal program, 320 intermediate pile bents in this structure were replaced during 1927, requiring the driving of 1,920 piles, varying in length from 65 to 75 ft. To provide for heavier loading in the future, all new bents have six piles.

Since 1928 more work has been done driving intermediate bents, while decay of the tops of piles has required more attention and caused more expense. The road is now probably facing a much more extensive renewal of stringers.

Decay at Cutoffs

Decay at the tops or cutoffs of piles has been the largest factor limiting the life and strength of the Lake Pontchartrain trestle. The piles were of generous diameter, so that the area of bearing between the cap and the ring of creosoted lumber of the pile was sufficient for the load, even when the inner part of the pile started to decay from lack of adequate treatment prior to construction.

This decay of the tops of the piles did not cause much concern until about 1920 (37 years life). Then piles here and there in various locations became so poor that strengthening was required. By 1932, (49 years life) there were only 1,038 out of an orig-

inal 8,056 piles that still carried the full load from the 15-ft. panels on each side. A careful inspection during that year showed that about 20 per cent of these piles had interior decay extending down from the top for several feet. Ten per cent of these piles had to be cut off and frame bents substituted. Other renewals were deferred for the time being by driving intermediate bents, which reduce the bent load by about 40 per cent.

Caps on the Lake Pontchartrain trestle have been highly stressed because of the spacing of piles in the bents. Yet records show that 53 per cent of the original caps are still in service, thus giving a life of 53 years. However, the load on the caps is now much reduced. Causes of failure have been the same as for any trestle caps, decay from ends, splits, crushing under stringer bearings, etc.

Ties have failed primarily from mechanical causes. They are too small properly to distribute the loading to the four-ply stringer chords, but no evidence of failure from this cause has been noticed. The sand and gravel used for fire protection seems to cause the most damage, especially around lining bolts. After decay once starts in a tie, the rapidity with which the decayed wood fiber is destroyed by the wear of the gravel is quite noticeable.

Loading Increased

In 1917, the loading in this trestle was increased by the use of 100-ton consolidation locomotives, so that for the last 20 years the stringers have been stressed as high in bending and in shear as we allow in any trestles, even when timber is new. Naturally, as the service life of these stringers under such loading reached 40 and 45 years, we desired positive assurance that the strength of the timber had not been reduced gradually for such stringers as showed no decay or defects from such inspection as can be given. Tests made in 1909, 1912 and 1928 showed clearly that no interior decay need be feared when it was not indicated by surface defects. Nevertheless, as many stringers have now given 53 years service, it is considered advisable to reduce the stresses, which results when intermediate bents are driven. The reduction of shear is almost 40 per cent and that of bending almost 70 per cent.

Tie renewals are made out-of-face and when the deck is exposed during such work, a thorough inspection of the stringers is possible. It is found that most stringer renewals are needed because the tops become soft, though some show much decay around lining bolts. Inspections made during 1935 and 1936 showed that many stringers are now getting soft on top. Of 1,232 stringers exposed and tested thoroughly in this two-year period, 170 or 13.8 per cent were renewed. However, conditions were not uniform. At almost half of the locations, renewals were 33 per cent. It is probable that this top decay is a result of mechanical action in the fibers, of the passage and retention of moisture, and of other conditions favorable to decay. Other causes of stringer renewals are softening at bearings, splits from the bottom surface along the grain, failure along annular rings similar to windshake cracks, and such defective conditions as usually occur in ordinary stringer maintenance. During the next two or three years we expect to complete the driving of intermediate bents in all of the original 15-ft. panels, and will face more extensive stringer renewals. Stringer joints remain on the caps of the original bents and the deck construction is the same that has always been used since the gravel covering was added. No doubt, some changes will be required within the next few years.

From time to time since 1919, four-pile and subsequently six-pile creosoted bents have been driven at the midpoints of the original 15-ft. panels. This work has been done to maintain safety of traffic while prolonging the service life of the original construction and, at the same time, gradually effect the renewal of the trestle over a number of years. Such work was first required because of the weakening of the piles in about 50 bents at the extreme south end of the trestle, where the piles were attacked by a species of marine borer, known locally by the workmen as "pill bugs."

Trestle on Grade

This section of the trestle was on a slight grade and was subject to considerable loading lengthwise of the track, resulting from braking action and traction, as northbound trains reduced speed over the trestle and as southbound trains picked up speed on leaving the trestle. Subsequently, such work has been required because of decay of piling at cut-off. This decay starts inside the outer ring of creosoted lumber but leaves an outer ring of creosoted lumber to give the required bearing for taking the load from the cap. When a bent is weakened by only a moderate amount of such decay, the driving of new pile bents in adjoining panels relieves the load on the old bent and defers replacement. When decay reaches the point where this become necessary, the piles are cut off near the level of the water and new half or whole framed bents are used on the piles cut off. New bents were constructed in the bridge as shown in the accompanying table.

The large number of bents driven in 1927 to 1929, inclusive, came about through recognition that the original piling and lumber had been in service for about 45 years and that decay was increasing decidedly in the top of many of the piling so that a program of work was necessary if excessive expenditures were to be avoided within one or two years. So much work had been done by 1930, that it has since been possible each year to do only that work required to maintain proper strength. Probably all original panels will be provided with intermediate bents within the next two or three years.

Number of New Bents Constructed Each Year Since 1919

Year	Four-pile bents	Six-pile bents
June 1919 to December 1925	556	—
1926	—	—
1927	—	320
1928	—	380
1929	—	420
1930	—	—
1931	—	—
1932	—	5
1933	—	36
1934	—	40
1935	—	60
1936	—	73*

*This work is authorized for 1936, and when completed, will leave only 126 of the original panels without intermediate bents.

Exclusive of three panels of ballast-deck construction at the extreme north end of the trestle, there are still in service 2,018 caps and 8,060 stringers of 6-in. by 16-in. by 30-ft. dimensions, in what may be termed the original construction. As a matter of fact, the original trestle placed in service on October 15, 1883, had only three-ply stringer chords or 6,045 stringers, but 2,015 stringers were added in 1906 to accommodate engine loadings of the New Orleans Great Northern. These were 8 in. by 16 in. in cross-section.

Definite figures are not now available for renewals prior to 1920. However, in May, 1918, a valuation engineer, after exhaustive search of all existing data, reported that only about 50 caps had been renewed since the original construction. Seven stringers were removed in 1909 for test. The remaining stringers are the original ones.

Inclusive of these figures the record of renewals is as shown in the table that is reproduced on the following page.

The specifications under which the timber was treated were furnished to me many years ago by James C. Haugh, the engineer who was account-

able for the building of the trestle; they were as follows:

Timber

The timber for creosoting shall be long-leaf or southern pine. Sap surfaces on two or more sides are preferred.

Piles

The piles shall be of long-leaf or southern pine, not less than 14 in. at the butt. They shall be free from defects impairing their strength, and shall be reasonably straight.

The piles shall be pealed cleanly, no inner skin being left on them. The oil used shall be so-called creosote oil, from London, England, and shall be of a heavy quality.

The treatment will vary according to the dimensions of the timbers and length of time they have been cut. Timbers of large and small dimensions shall not be treated in the same charge, neither shall timbers of differing stages of air seasoning, or the close-grained, be treated in the same charge with coarse or open-grained timbers.

The timbers shall be subjected first to live steam superheated to from 250 to 275 deg. F., and under a 30- to 40-lb. pressure. The live steam shall be admitted into the cylinders through perforated steam pipes, and the temperature shall be obtained by using superheated steam in closed pipes in the cylinders.

The length of time this steaming shall last will depend on the size of the timbers and the length of time they have been cut. In piles and large timbers freshly cut, as long a time as 12 hours may be required. After the steaming is accomplished, the live steam shall be shut off and the superheated steam shall be maintained at a temperature of 160 deg. or more and a vacuum of from 20 to 25 in. shall be held for four hours or longer, if the discharge from the pumps indicates the necessity.

Oil Treatment

The temperature being maintained at 160 deg. F., the cylinders shall be filled promptly with creosote oil at a temperature as high as practicable (about 100 deg., F.). The oil shall be maintained at a pressure ranging from 100 to 120 lbs., as experience and measurements must determine the length of time the oil treatment shall continue, so that the required amount of oil shall be injected.

After the required amount of oil is injected, the superheated steam shall be shut off, the oil let out, the cylinders opened promptly at each end, and the timber removed immediately from the cylinder.

In the erection of timbers the sap side must be turned up, and framing or cutting of timbers shall not be permitted if avoidable. All cut surfaces of timbers shall be saturated with hot asphaltum, thinned with creosote oil. The heads of piles when cut shall be promptly coated with the hot asphaltum and oil, even though the cut-off be temporary.

Table of Stringer, Cap and Tie Renewals by Years

Year	Stringers	Caps	Ties*
Prior to 1920	7	50	—
1920	—	143	42
1921	—	85	288
1922	18	107	1721
1923	33	17	2232
1924	36	21	2076
1925	43	24	2690
1926	51	55	2848
1927	21	54	375
1928	26	69	384
1929	12	68	—
1930	26	64	1023
1931	48	55	258
1932	12	40	526
1933	43	38	929
1934	53	41	1700
1935	105	5	1434
Totals†	534	936	18256
Average per year	33.4	58.5	1141

The average number of yearly renewals, compared with the number in service, gives 0.41, 2.90 and 0.38 per cent for stringers, caps and ties respectively.

*Figures for tie renewal have little value as indicating the life of the creosoted ties, of which there are approximately 30,000 in service. For fi e protection, sand and gravel are used to cover the deck of the trestle which increases the wear decidedly and also tends somewhat to increase decay by some retention of moisture. When the trestle was built in 1883, 60-lb. rails were used on the ties without plates. Mechanical action was so severe that in 1894 (11 years) the ties were turned over and tie plates applied. In 1902, 75-lb. rails were laid but the small 60-lb. tie plates we e kept in service. By 1918, 75-lb. tie plates had been applied and all of the original ties had been renewed. For several years, tie renewals averaged 1,500 annually, equivalent to a life of 20 years. In 1935, 80-lb. rails were laid. Engine loading was increased in 1906 and again in 1917 to the present axle load of about 45,000 lb.

†Recent inspections indicate that a marked increase may be expected in renewals of ties and stringers.

Ohio River Flood

(Continued from page 96)

69 ft. on January 27, the terminals of the Chesapeake & Ohio were inundated, while this company's line between Huntington and Cincinnati, which follows the south bank of the Ohio river, was submerged at various points. At Portsmouth, Ohio, the classification yard and engine terminal of the Norfolk & Western were flooded when sewer valves in the city were opened to relieve the pressure against the "sea wall" which was built several years ago to protect this city from the Ohio river. Traffic over the branch line of the Baltimore & Ohio to Portsmouth was suspended because of difficulty at that point, while service over the B. & O. to the same point was also cancelled.

At Evansville

Railroad facilities at Evansville, Ind., where the Ohio river reached a stage of more than 53 ft., were flooded and the approach to the Louisville & Nashville bridge at Henderson, Ky., became impassable on January 22. As a result the lines of the Big Four, the L. & N., and the Chicago & Eastern Illinois at Evansville were out of service.

While the water at Pittsburgh, Pa., did not reach the mark established in March, 1936, it resulted in the flooding of the Pittsburgh & Lake Erie tracks and forced the Baltimore & Ohio, which operates over the P. & L.E. through Pittsburgh, to route its trains over its own line.

In addition to its difficulties at Louisville, the Illinois Central experienced extensive property damage and disruption of service on other portions of its lines. Extensive slides in a cut at Wickliffe, Ky., on the Chicago-New Orleans line on January 20 definitely interrupted service between those points, while as the result of a levee failure water was flowing over the tracks at Mounds, Ill., on the same line. Moreover, service over this company's alternate line through Paducah, which involves use of the Edgewood cut off, was stopped because of slides in cuts on the Edgewood cut off and on the Paducah-Fulton line south of the Ohio river. In addition service over the Illinois Central's line to Louisville was at a stand still because of the flood waters at Paducah which rose to a depth of 4 ft. in the company's system locomotive repair shop at that point, and because of back water in the Tennessee and Cumberland rivers.

"Don't Let It Occur to You"

(Continued from page 103)

main track and No. 1 yard track. He both saw and heard a yard engine coming down the main track behind him and about the time it reached him he stepped up on the yard track and was fatally injured. Before he died, he said he was sure the engine was on the main track, but between the time he saw it and the time it struck him it had changed.

"Fouling a track is about as bad as being on the track, as a person often thinks he is "In the Clear" when he is not.

Two track laborers were assigned the work of clearing snow out of switches in a very busy yard. The weather was very cold and both men were blinded by a blizzard of falling snow and heavy wind. It was hard to hear. For these reasons, these men had been put to work together with instructions that they should remain together, and while one worked the other would protect him. In disobedience of these instructions they separated, one of the men going to the next switch, where he started work. Before the other laborer could get to him or warn him, he was struck by a yard cut and instantly killed.

What's the Answer?

Damaging Ties Before Insertion

In what ways may treated ties be damaged before they are inserted in the track? What can be done to overcome this abuse?

Careful Handling Required

By C. S. KIRKPATRICK
Chief Engineer, Missouri Pacific Lines, Houston, Tex.

When ties are sent out on the road they should be unloaded carefully to insure that they will not be broken or have the edges knocked off. Timber, such as oak and gum, which is not penetrated deeply by the preservative, depends on the outside coating for its preservation and it is extremely important that this coating remain intact. If the ties are not to be used immediately, they should be stacked in tight piles so that the treatment cannot evaporate. There should, however, be sufficient air space in the piles to permit evaporation of any water that may be left in the ties. In other words, it is important that treated ties be allowed to season before use. These piles should be placed where there will be no water standing around them and where they will be convenient to pick up and distribute.

When inserting ties in the track, picks, shovels or other sharp instruments should not be used for pulling them into the track. Tie tongs should be used for this purpose. Spike mauls or sledges should not be used for spacing ties, for they break the outer coating of treatment and decay is likely to start at the point of damage.

The only way to insure the proper handling of treated ties is to see that every one involved understands the purpose and value of treatment and that when untreated wood is exposed to the elements, by either abrasion or the use of sharp instruments, it will soon decay. Driving the spikes in the holes that are bored to receive them and the proper setting of the tie plates are important factors in tie conservation. In fact, the whole matter of the handling of ties is important, and proper methods of handling after treatment will increase substantially the service life that can be obtained from them.

Starts in the Woods

By J. MORGAN
Supervisor, Central of Georgia, Leeds, Ala.

Starting in the forest, the tree from which the tie is cut should be sound, free from decay and wind shakes and of the proper density. The tie should be seasoned under sanitary conditions and treated as soon as the wood is dry enough to receive the preservative. During this period the bottom of the piles should be kept well above the ground to prevent decay in the bottom courses.

After treatment, they should be handled carefully to avoid fracture, splitting, bruising, tearing of the fibre and warping. To prevent too rapid drying and possible evaporation or bleeding of the preservative, they should be stacked in close piles and covered with a thin layer of earth. Tie tongs should be used for pulling them into the track; in no case should picks or shovels be used to do this. After insertion any shifting that may be necessary should be done with a bar and not with a spike maul or sledge.

Summing it all up, it amounts to this: Do not bruise or otherwise abuse the wood either at the treating plant, in distributing the ties or in inserting them in the track. Bruising, scarring and abrasion are certain to open the way to decay, and they are so unnecessary that it is a wonder that they are still the subject of dis-

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in April

1. What methods can be employed to prevent the gullying of high embankments or the slopes of cuts? How should the work be done?

2. What precautions should be observed to prevent damage to treated timbers in the field?

3. Is there any danger of being poisoned from handling creosoted ties or timber? Are there other undesirable effects? If so, what can be done to prevent the trouble?

4. What methods should be employed in painting badly weathered wood surfaces?

5. What is the cause of horizontal splits between the head and web of rails? Do they occur more often on the high or low rail on curves? Why? Do the first indications of this defect appear on the outer or inner side of the rail? Why?

8. How does one clean out a deep well when it becomes choked with sand inside the casing?

7. Can tie renewals be made more economically by section gangs or by extra gangs? Why?

8. To what extent is it more difficult to get good workmanship on an up-weld than on a down-weld in structural-steel work? Why? To what extent is it desirable to modify the plans for the work to avoid up-welding?

cussion, but we still have a long way to go before these abuses in the handling of ties are eliminated.

Curb Carelessness

By L. H. Harper
Superintendent Creosote Plant, Central of Georgia, Macon, Ga.

Doubtless, the question refers to damage after treatment, but it may not be amiss to mention another important factor in tie life—damage from improper care or overseasoning before treatment. This can be prevented by shipping the freshly cut ties to the treating plant where they can be seasoned under trained observation and clean surroundings, and where records of their age and condition can be kept. This is not always practicable, but in any event the ties should be watched carefully for incipient decay during the seasoning period, and no tie showing the slightest decay should be treated

After treatment, damage may occur when they are unloaded by throwing them carelessly from the cars and allowing them to strike rails, rocks or other hard materials, causing them to break, split, abrade or become bruised. Again, dropping one tie onto another may tear the fibre or break one of the ties. This can be overcome by dropping the ties singly in such manner that each one will fall flat onto the ground.

When freshly treated ties are distributed, they may be damaged by being left carelessly along the right of way to warp, check or be damaged by grass fires. If they are not to be used shortly, they should be stacked in close piles, and covered with a thin layer of earth to prevent checking and sun bleach. The grass should be cleared to prevent fire reaching them, and they should remain in the piles for a least 30 days before insertion in the track to give the wood an opportunity to become firm.

While being removed from the stacks or inserted in the track, the ties can be damaged seriously through the use of sharp instruments, such as picks, and shovels, which mutilate the timber and make openings into the untreated wood, giving access to decay organisms. For the same reason, ties should never be struck on either the sides or ends to space them or bring them into position for spiking. Bars or tie spacers should be used instead. Machine adzing has made unnecessary much of the hand adzing done formerly, but where adzing becomes necessary the cut surface should be painted with at least two coats of hot creosote.

All of the abuses cited, and others might be mentioned, can be overcome by adopting rules covering every phase of the handling of treated ties, and then seeing that they are enforced. Education is necessary, and it is sometimes a slow process, but when coupled with intelligent supervision it will be effective in preventing damage and will thereby prolong the service life of the ties.

Damage Unnecessary

By L. A. Rape
Section Foreman, Baltimore & Ohio, Wampum, Pa.

While ties do receive much damage in handling, some of which is not readily apparent when it occurs, which definitely shortens their service life, barring unavoidable accidents, all of it is unnecessary. To conserve this life a few simple rules are all that is required. In handling, whether from cars or into the track, do not allow the wood to be bruised, splintered, abraded or cut. If the ties are not to be used immediately they should be piled, always with the heart side down to avoid excessive checking, in close piles. If checking has started, turn the checked side down. Keep the grass cut around the piles.

Do not allow ties to lie in ditches or in water elsewhere, for they are likely to split when drying out, and certain preservatives may leach out in the water. The piles should be covered with a thin layer of earth to prevent bleeding, sun bleaching, warping and the too rapid drying of ties that are freshly treated.

Makes Several Suggestions

By T. J. Leonard
Track Supervisor, Erie, Hackensack, N. J.

Consideration of this subject goes back to the treating plant where proper care should be exercised in loading the ties so that they can be unloaded properly. When they are being distributed they should not be allowed to strike rails or other hard objects on the ground, or be thrown carelessly from the cars to strike one another. If they are not to be used promptly they should be stacked in standard piles and protected against damage or destruction by fire.

When they are being inserted in the track they can be damaged seriously if picks, shovels or other sharp tools are employed to pull them into place. For this reason, tie tongs should be used in this operation.

Drinking Softened Water

Does the softening of water for locomotive-boiler use render it unfit for drinking? Why? If so, can the softened water be made fit for drinking?

Depends on Treatment

By R. C. Bardwell
Superintendent Water Supply, Chesapeake & Ohio, Richmond, Va.

In answering this question, the three major types of treatment must be considered individually. These types which are in general use are (1) complete lime and soda ash, (2) zeolite, and (3) the wayside-tank method.

Treatment with lime and soda ash, if carried out properly, does not render the water unfit for drinking purposes. On the other hand, this treatment will kill the injurious water-borne disease bacteria and can be relied upon to make a water which was grossly polluted originally, safe for drinking. Water-borne disease germs cannot continue to exist in a water carrying a small amount of caustic alkalinity such as is normally present in properly treated lime and soda ash softened water. The coagulation and sedimentation, together with the four to six-hour retention period, affords sufficient time to eliminate this type of pathogenic bacteria. The slight amount of caustic soda present has no adverse physiological effect on the human system, as is evidenced by the fact that cow's milk prepared for consumption by infants is frequently treated with a more concentrated lime water than is present in this treated water. The only reasonable objection to the use of this water for drinking is the flat taste resulting from the absence of carbon dioxide, which is noticeable when the water is warm but not when it is cold. If this flat taste is objectionable, the water can be treated with alum or copperas to reduce the causticity and filtered through a pressure sand filter, or if further refinements are desired, the water can be carbon-

ated or treated with activated carbon.

The zeolite method, in itself, should not appreciably affect the quality of the water for drinking. However, it does not have the bactericidal qualities of the lime-soda method and if pollution is introduced with the salt solution which is used for regeneration, there is this possibility that the entire supply will be rendered unsafe. To maintain such a water in a safe condition after softening, supplemental treatment with chlorine or caustic soda should be applied.

In the wayside-tank method of softening, only partial chemical treatment is applied to neutralize the incrusting sulphates or chlorides. The pH value of the water is not usually carried sufficiently high to eliminate B. Coli and similar bacteria. In addition, organic chemicals, principally some forms of tannin, are frequently used with soda ash in order to reduce the tendency toward pipe-line incrustation. Such chemicals are considered poisonous in moderate amounts and the use of such water should be avoided. In other words, except under special conditions, such a method of softening renders the water unfit for drinking and provision should be made to obtain the supply of drinking water elsewhere.

Can Be Made Safe

By E. L. E. Zahm

Water Service Inspector, Missouri-Kansas-Texas, Parsons, Kan.

The United States Health Service requires, with respect to chemical and physical characteristics, that a water to be suitable for drinking and culinary purposes, and this applies to common carriers engaged in interstate traffic, shall be clear, colorless, odorless, pleasant to the taste, free from toxic salts and that it should not contain an excessive amount of soluble mineral substances, or any chemicals employed in treatment. In addition, from the sanitary aspect, the supply shall be obtained from a source free from pollution or from a source adequately protected by natural agencies from the effects of pollution, or adequately protected by artificial treatment.

In general, water treated for locomotive-boiler use is not desirable for drinking purposes since it will not approach the standards outlined. However, such waters may be treated further to make them satisfactory, and in some cases the softened water may be safer than other available supplies. With the lime-soda ash process of softening water for locomotive-boiler use, the effluent can usually be made fit for drinking.

This form of treatment has a decided bactericidal effect, but this is not generally sufficient to preclude the necessity for chlorination if the original source of supply is unsafe. The caustic alkalinity in the softened water is obviously objectionable, but this can easily be neutralized by the use of alum. If the effluent from the softener is not entirely clear, a small filter may be used to provide a clear, sparkling drinking water. Objectionable tastes and odors may also be removed by the use of proper compounds. In fact, with a comparatively small initial outlay, equipment may be provided in connection with the softening plant to furnish an effluent that will meet all requirements.

Cementing Gravel or Stone?

When a soft roadbed on a heavy-traffic line is ballasted with 8 or 10 in. of cementing gravel, is it better to continue its use when the track is resurfaced, or to apply stone ballast? Why?

Does Not Favor Stone

By P. T. Robinson

Engineer Maintenance of Way and Structures, Southern Pacific, San Francisco, Cal.

We do not favor the use of stone on any soft or settling fill, for the reason that as the track or fill settles, it will be necessary to continue the use of the broken stone to keep the track up to grade. Obviously, the more rock that is applied, the larger the water-pocket will become, finally forming a bowl which, as it increases in size, will hold more water.

The continued use of gravel or cinders, or both, with proper drainage is more desirable. If proper drainage is practicable, gravel and cinders mixed should be used for maintaining the track until the roadbed dries out and becomes stabilized. Just as good riding track can be maintained on gravel or cinders, preferably mixed, on soft or settling fills, as on the more expensive crushed stone. Besides this, if frequent surfacing and tamping are necessary, the cost of the labor will be much less and there will be less damage to the bottom edges of the ties.

Cementing Gravel Better

By K. H. Hanger

Engineer Maintenance of Way, Missouri-Kansas-Texas, Dallas, Tex.

Under the conditions outlined, cementing gravel or other impervious ballast will be much better than stone ballast. The fact that the roadbed is soft indicates that there will continue to be deviations from good line and surface that will require spotting and resurfacing. This can be done much more satisfactorily in a satisfactory type of cementing gravel than in rock.

So far as the effect on the roadbed itself is concerned, the use of the cementing gravel should be continued, since, because of its impervious nature, when it settles into the roadbed it does not create water pockets, as is done with a pervious ballast, such as rock and other materials which allow water to filter through them.

To replace ballast of the nature of cementing gravel with rock or other equally pervious material on an admittedly soft roadbed would be merely to court trouble and greater expense in spotting and resurfacing the track and in combatting and correcting the formation of water pockets, with their attendant trouble, as a result of the pervious material sinking into the roadbed in forms which are difficult and sometimes almost impossible to drain.

Gravel Sheds Water

By T. M. Pittman

Division Engineer, Illinois Central, Water Valley, Miss.

Under the condition stated the best practice will depend on the degree of softness of the roadbed and the volume of traffic, but for the depth of ballast assumed it will usually be better to continue the use of the gravel. The greatest value of cementing gravel on a soft roadbed is that, being practically impervious, in effect it forms a roof over the roadbed which sheds the water to the shoulders where it is quickly disposed of.

If this gravel roof is not strong enough to support the stone, the latter will break through it under the ties and let the water seep into the subgrade, forming a water pocket or trough under the track. Under these conditions it will be very expensive

to maintain the track on the stone ballast and it will be better to continue the use of the gravel.

While the depth of gravel necessary to give the proper strength will depend in large part on the character of the roadbed, the character and volume of traffic are important factors. In general, however, a minimum depth of about 18 in. of gravel will be required to support the stone ballast. Where the depth of the cementing gravel is sufficient to give this support, the use of stone will be preferable.

Wants More Ballast

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

From my experience with soft roadbed, and considering material of low supporting power rather than soft spots or water pockets, although these may develop, I do not consider 8 or 10 in. of any kind of ballast sufficient to give the proper distribution of the load on any but very light-traffic lines. Most certainly, in surfacing track on a soft roadbed, I would not substitute stone ballast for cementing gravel. Neither would I superimpose stone ballast on 8 or 10 in. of the gravel.

Cementing gravel has many disadvantages, but under the conditions imposed in the question it may be the best material that can be used, provided it is of sufficient depth, for it will shed water and thus keep the roadbed dry. This is particularly important where the roadbed material might become highly plastic when moist or is of the type that holds water tenaciously.

In most cases, so far as plastic movement of the soft roadbed is concerned, adequate drainage to insure that it will be kept dry is fully as important as the kind of ballast that is used. Where cementing gravel is used in sufficient depth to prevent the traffic loads breaking through, there is the added advantage that surface water will not reach the roadbed through the ballast and water pockets will be avoided, even though the ballast may settle into the roadbed material because of its low supporting power. Assuming that this depth is sufficient to support the stone ballast without being broken up, there should be no serious objection to placing this ballast on top of the cementing gravel.

Reducing Work-Train Expense

What methods can be employed to reduce work-train expense without holding cars out of revenue service unduly?

Careful Planning Needed

By G. D. Mayor
Assistant Cost Engineer, Chesapeake & Ohio, St. Albans, W. Va.

No item of expense in railway maintenance will pay greater dividends as a result of careful planning and close supervision, than that of work-train service. Too often, work-train expense is out of all proportion to the service performed. Usually this results from lack of system and poor co-operation between the departments involved.

When possible, the stores department should consolidate shipments, billing them to the supervisor when all items have been assembled, wiring him the date of billing and car numbers, thus enabling him to arrange in advance for prompt unloading upon receipt. Knowing the approximate time of arrival, the supervisor should discuss the work with the local transportation officer, to determine whether a work train will be necessary or whether a local or other revenue train will be able to do the work. Often, where only two or three hours of such service are required, the unloading can be done in this way at little extra expense. Where a shipment involves only a single car, it can sometimes be spotted on a convenient siding for unloading and the material trucked to the point of use. Here, the cost of trucking must be compared with the cost of handling by work train.

On days when light power is to be moved, the chief dispatcher should notify the division engineer, who may be able to use it in place of calling a work train, thus saving a full crew day. The local transportation officer should exercise the same careful supervision over the movement of a work train, that he does with revenue trains, expediting it as much as practicable without delaying revenue business.

Trick dispatchers should be fully informed of the movements to be made and the work to be performed, to enable them to plan all train movements in such a way as to insure the minimum of delays. Too frequently, a work train is looked upon as a sort of step child, and is held in sidings unnecessarily and otherwise delayed for the simple reason that a trick dispatcher is seldom criticized for delaying a work train, but may be criticized severely when a revenue train is delayed.

To keep work-train expense to the minimum and at the same time release cars promptly, it is necessary to plan all details in advance. It is equally necessary to secure the interested and friendly co-operation of all of the departments involved, and to supervise the actual performance carefully. If this is done, the results in better performance and lower costs will be amazing.

Depend on Local Trains

By Thomas Walker
Roadmaster, Louisville & Nashville, Evansville, Ind.

If I understand the question correctly, I would say that, so far as practicable, it might be well to utilize local and other revenue trains which are available for handling work that requires only short periods of work-train service. Where it is practicable to use such trains, the road work can be handled in small installments daily, thus releasing the cars more promptly than if they are allowed to accumulate in sufficient number to justify calling a work train for a full day.

There are also many items of track material that can be handled by motor and push cars, trucking them from stations where they have been stored. As an illustration, if renewals are not too heavy, crossties can be unloaded without resorting to a work train and stored at stations. The foreman can then truck them out to the work in sufficient numbers each day to take care of his day's work. Obviously, however, the advantage of this method will depend on the distance they must be trucked and the number of ties to be renewed. Where a section is well equipped with creosoted ties and the renewals are light, this is probably the best and least expensive way of distributing crossties.

Again, rail cranes or self-propelled locomotive cranes can be used for trucking and unloading rail, provided the haul is not too great. For the general run of maintenance work, I find that it is usually practicable to handle most road work with local trains. It thus becomes necessary to

call work trains only at intervals when the work has accumulated in sufficient volume so that the local train does not have sufficient time to reduce the accumulation. This plan will depend, however, on the local conditions and whether revenue trains are available to do the work.

Characteristics of Paint

What characteristics are fundamental in a paint for protecting steel surfaces?

Must Retard Corrosion

By C. Miles Burpee
Research Engineer, Delaware & Hudson, Albany, N. Y.

Generally speaking, the fundamental purpose in applying paint to steel is for its protection and for the prevention or retardation of corrosion. For this reason, while laboratory analyses and accelerated weathering tests of sample panels are of considerable value in preparing or selecting paints suitable as protective coatings, the final selection should be based upon results of actual exposure in service over a suitable period. When the selection is made in this manner, doubtless the paint will be found to possess the following characteristics, among others, which are fundamental for a protective coating:

(1) A finely ground pigment which has a good affinity for the oil vehicle, this being necessary to produce a film that is impervious to air and moisture; (2) it works well under the brush and flows evenly, thus producing a thin film which is not porous; (3) it does not contain any substance which will accelerate corrosion; and (4) the paint film possesses sufficient elasticity to conform to the expansion and contraction of the steel under temperature changes and also to withstand vibration for a long time.

Prime coats should have plenty of pigment and dry firm. They must not be brittle, however, since they will not otherwise resist abrupt physical contact or blows, which may cause them to flake or peel from the steel. In the past, red lead in linseed oil required a drying period of several days before the following coat could be applied. This was a serious disadvantage, particularly for bridge-floor systems and other places where considerable damage is likely to result from abrasion by physical contact with external objects, in addition to the collection of dirt and other foreign substances in the film. Faster drying red-lead primers are now available, which overcome these objections and which are giving good results after long periods of exposure.

For maintenance purposes it is well to select a paint, the characteristics and protective value of which are known from past performance in the territory in which it is to be used. Its reaction and effective life over old films will thus be known. Once a satisfactory painting program is established, it should be continued by employing the tested paints rather than to apply paints of entirely different characteristics, the reactions with the old paint and the protective value of which are unknown.

Must Be Elastic

By Division Engineer

Primarily, paint is applied to steel to prevent access of moisture to the surface, thus protecting it against corrosion. For this reason, the paint film should remain impervious to moisture during its service life and retain sufficient elasticity to expand and contract without rupture as the steel responds to changes of temperature.

Pigments should be finely ground and dispersed evenly through the vehicle, and should be inert to the metal. For the priming coat, the pigment should act to some extent as a rust inhibitor. Finely ground red lead which is as near chemically pure as practicable, has been found through long experience to possess this property to a high degree, and so far no material suitable as a pigment in paint has been found which is superior to it. Fine grinding of the pigment is necessary to permit the application of a thin paint film. This is a fundamental requirement for paint, for when paint is applied in thick layers it almost invariably fails by cracking and peeling.

To produce a thin film, the paint must work well under the brush, that is, it must flow smoothly and evenly and be susceptible of being spread over the surface to a uniform thickness without too much brushing. How the paint dries is also important. Drying too quickly is likely to cause brittleness in the film and too long a drying period affords an opportunity for damage while the paint is still wet, besides making the painting operation too long drawn out. Furthermore, a slow-drying paint is often soft and sticky, rather than firm and hard.

How Far to Go?

How does one determine whether a frog or crossing should be built up or repaired? Are we going too far today in rebuilding frogs and crossings? Why?

Art Has Advanced

By G. A. Phillips
Chief Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Determining whether a frog or crossing should be built up or repaired is not done on the same basis as it was even as recently as four or five years ago. In this short time the art of welding, the development of welding equipment, welding rods and the technic of the operations have so progressed that much frog and crossing repair work by welding is now carried out successfully, which was formerly thought to be entirely impracticable. As a matter of fact, extensive work of this character has been done by a number of roads for at least four or five years.

Admittedly, there is a possibility of going too far in the rebuilding of frogs and crossings, but danger in this respect is less than it used to be. The greater danger is that not enough attention will be given to the repair of these units of trackwork, thus allowing them to get into such condition that costly, and sometimes difficult, repairs will be necessary. It is my thought that the natural wear and batter of otherwise sound frogs and crossings should never be allowed to approach the point where renewal of the units as a whole seems necessary or advisable. Where the necessary facilities can be afforded, the ideal arrangement is to keep frogs and crossings in a constant state of good repair, touching them up by welding, as necessary to attain this end. I have seen the service life of hundreds of

these units prolonged year after year by this method, with unquestionable economy and improved track conditions, and incidentally, with large savings from the standpoint of reduced damage to motive power and cars.

Not Until Worn Out

By Charles Wise
Maintenance of Way Welder, Chicago & North Western, Proviso, Ill.

Several factors must be given consideration in deciding whether a frog or crossing should be built up. The first is the general condition of the unit, aside from that of the surfaces to be built up. If it is in reasonably good shape the welding can be done to advantage. If the unit seems to be in good repair, one should lay a straight edge across the worn surface to determine how much metal must be added, placing the straight edge along the wing rails and over the point and measuring the average depth of the weld. Ordinarily this will range from ¼ to ¾ in. If it is ¾ in. or more the unit is badly worn and the cost of the welding will be high. To avoid this and insure that the frog or crossing will remain in good condition for a much longer period, the welding should be done when the wear reaches ¼ in., and it should never be delayed much beyond this.

I believe that few roads carry the building up of frogs and crossings too far. Rather, there is a tendency not to do the welding soon enough, thus allowing the unit to receive unnecessary abuse, which obviously shortens its life. In other words, by giving it the proper attention and welding the surfaces before they are too badly battered, a frog or crossing can be kept in service until it is ready to be scrapped for other reasons.

Batter Kills Them

By L. A. Rape
Section Foreman, Baltimore & Ohio, Wampum, Pa.

Two items are important in determining whether a frog or crossing should be built up, these being the amount of batter present and the general condition of the unit. Sometimes, what was thought to be batter turns out to be a horizontal fissure, in which case it will be useless to do the welding. Angle bars should be removed to find whether bolt-hole breaks have started at the ends of the wing rails, in which event the frog should be discarded. It may be possible, however, to replace a defective wing rail in a crossing. If the running rail is worn enough for the wheel flanges to ride on the fillers, or if the unit is so worn generally that the bolts cannot be kept tight, it should be renewed instead of repaired.

Perhaps some frogs and crossings have been built up at too great expense, but on the whole this is not the danger, as I see it. Rather, too many units are allowed to deteriorate too far before they receive attention. The old adage that a stitch in time saves nine applies with full force to the building up of frogs and crossings. If they are given the frequent attention they should have, they can be made to last and give satisfactory service until the rail is worn out.

Opinions Will Vary

By J. Morgan
Supervisor, Central of Georgia, Leeds, Ala.

Opinions on this subject are likely to vary widely, depending on the practices in vogue and the amount of work allotted to the welding forces. It is my experience that if the frogs and crossings are kept built up they can be kept in service until the wear on the running surface has progressed to the point where it is advisable to renew them.

If they are kept built up so that the running surface is smooth, there will be no undue wear on the component parts of the assembly, and under natural wear either unit will last a long time. If, on the other hand, batter is allowed to accumulate, the jolt of the passing wheels will cause relative movement between the parts, rapid wear and loose bolts. When this wear has reached the point where it is difficult to keep the bolts tight, the frog or crossing is about ready for the scrap pile. Much of this wear can be avoided by keeping the battered surfaces built up, not allowing the batter to progress to the point where there is abnormal jar as the wheels pass over the unit.

I do not believe that there is any immediate danger of going too far with the building up of frogs and crossings. I think the danger lies in allotting the welding forces too much work to permit them to give these units the frequent attention they deserve. Furthermore, supervisory officers may not be fully alert to the advantage of keeping the running surface smooth. As applied to trackwork, welding is a comparatively new art, and most of us are a little slow in realizing all of the advantages and implications of the new ideas and methods that can be applied.

When Should Bents Be Braced?

How far above the ground is it good practice to allow pile bents to project before applying sway bracing? Longitudinal bracing? What considerations other than height affect this? Why?

Makes 3 Ft. the Limit

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

Consideration of this question must take into account the character of the line and the traffic. On a line of light traffic and relatively low speed the standards do not need to be as high as on a heavy-traffic main line where the speeds are not limited. On the main line the trestle should have six-pile bents with all piles battered. The center piles should have a batter of ½ in. to the foot; the intermediate piles 1 in. to the foot; and the batter of the outside piles should be 2 in. to the foot.

In such a bent, bracing need not be applied until the distance from the cap to the ground is greater than 3 ft. By anchoring the cap to the piles and the stringers to the cap by means of 2-in. by 3-in. angles, a bent of this height will be stiff enough not to need braces. With the slower speeds usually maintained on branch lines, this limit will be 5 ft. for a four or six-pile bent, provided the track is on tangent. On curves exceeding 40 min. or if the speed is relatively high the limit should be reduced.

Consideration should always be given to the location of the structure and the character of the ground in

deciding on the application of lateral and longitudinal bracing. In many respects the substructure, the bent, is the most important part of a pile trestle. To obtain best service from it, the piles should have sufficient penetration to insure against settlement and should be driven accurately in such a way that there will be the minimum space between the piles at the level of the cap.

It is our practice to avoid longitudinal braces on all trestles, so far as practicable, since so many of them are in overflow districts. We have not a few trestles on high-speed tracks, with bents more than 40 ft. high, which have neither longitudinal nor tower bracing, and we have had no trouble with the bents tipping or going out of line. Where bents do require more stiffening than is afforded by the sway bracing, we apply both longitudinal and tower bracing when the height is greater than 25 ft., particularly on frame-bent trestles.

Stiffness Is Important

By General Bridge Inspector

In general, the limit of height below which lateral bracing can be eliminated from pile trestles will depend on the soil into which the bents are driven, the penetration of the piles, the volume and speed of traffic and the alinement. Stiffness is an important requisite in a trestle bent, and its importance increases as the volume and speed of traffic increase. A bent in which the piles have ample batter has greater lateral stiffness than one in which the piles are insufficiently battered.

For this reason, on our lower trestles we drive the center piles of a six-pile bent vertical, giving 1 to 1½ in. batter to the intermediate piles and 2½ to 3 in. to the outside piles. In this way, where the ground is solid and stable we do not consider lateral bracing necessary until the height reaches 5 ft. For four-pile trestles on branch lines we batter all piles and apply bracing above 6 ft. If the ground is soft or unstable we may begin to apply the braces at heights of 3 to 4 ft. on both main and branch lines. Again, as the speed of trains, particularly freight trains, increases it may be necessary to lower this limit, even in solid ground. Where the track is on a curve we ignore other considerations and begin to apply the braces at about 3 to 3.5 ft.

Ordinarily we do not apply longitudinal bracing to bents less than 20 ft. high, and in many cases they are considerably higher than this before we brace them. However, on steep grades and where considerable braking is done, both longitudinal and tower bracing may be necessary at heights well under 20 ft. Before applying longtitudinal bracing one should study thoroughly the probability of high water with drift and floating ice. I have known more than one structure that went out because this was not done.

Finishing Foundation Walls

Should foundation walls for frame buildings be finished flush with the underside of the floor joists or be carried up around them to the floor level? Why?

Under the Joists

By Frank R. Judd
Engineer of Buildings, Illinois Central, Chicago

In the construction of frame buildings, when masonry foundations are installed, it is the usual practice to finish the foundation at the level of the underside of the girders or floor joists. Sometimes, after the floor framing has been placed on top of such foundation walls, a filling is placed between the joists to form a barrier against rodents.

These masonry barriers may also have a tendency to offer some protection against termite invasion, especially in buildings having basements, but this is purely speculative. They also act as fire stops. In general, however, it is inadvisable to use masonry construction to enclose untreated timber, since it prevents circulation of the air around the wood and promotes decay to a greater degree than when the timber is left exposed. To reduce the probability of decay and to minimize the chance of termite infestation, it might be well to consider the use of treated timber for all construction immediately above the foundations, although in many cases the increased cost must be taken into account as this may be the determining factor.

Might Damage Walls

By Daniel Mack
Architect, Delaware, Lackawanna & Western, Hoboken, N. J.

In heavy-mill and concrete structures, where wood floors have been installed, the side walls are generally of brick or other masonry and the joists are set in the masonry. However, I prefer to stop the masonry walls at the level of the bottom of the joists. This construction will enable one to line the floor beams more perfectly and frame the entire floor as a unit, anchoring it to the top of the wall with anchor bolts.

My chief objection to extending the masonry up to the underside of the floor, aside from the feature already mentioned, is the probability that unequal shrinkage will develop, since the frame of the exterior walls will rest on the masonry, while the frames for the partition walls will be carried on the timber beams. This almost invariably causes cracking of the plaster where these two walls join.

The question of dry rot must also be considered if the ends of the joists are to be enclosed, although this can be retarded to some degree by careful selection of the timber for the joists. I know of only one argument in favor of enclosing the beams in masonry, this being that it affords a better stop against the entrance of fire and rodents.

Necessary in North

By Andrew Finnes
Master Carpenter, Great Northern, Minot, N. D.

In the northern section of the country, where temperatures range far below zero during the winter months and where high winds often accompany winter storms, it is not only desirable but almost a necessity to carry foundation walls to the level of the top of the floor joists. If this is done properly it forms a solid, tight joint between the foundation wall and the superstructure.

To make a snug joint which will offer maximum resistance to infiltration of cold air or leakage under wind pressure, the joists can be placed in the forms and the concrete can be deposited around them, filling the forms to the top of the timbers. Then, when the floor is laid, it rests on the foundation wall, making a tight joint.

To place the joists on a timber sill on top of the finished foundation wall leaves a wide-open joint between the foundation and the superstructure. It is extremely difficult to make this opening weather tight, with the result that, unless well insulated, the floor will be cold.

News of the Month

Apportions Grade Crossing Fund

The secretary of agriculture has apportioned $50,000,000 among the various states for the elimination of hazards at grade crossings. These allotments are for the fiscal year beginning July 1, 1937, and are not included in the grade elimination program now under way. The biggest beneficiary of the new apportionment is the state of New York, which has been allotted $3,424,399. Pennsylvania is second with $2,905,671, Texas is third with $2,724,825, and Illinois next with $2,644,980.

1936 Car Loadings Highest Since 1931

Freight traffic on the railroads of the United States was greater in 1936 than in any year since 1931, according to the Association of American Railroads. Complete reports for the year showed that 36,063,307 cars were loaded with revenue freight in 1936. This represented an increase of 4,559,173 cars, or 14.5 per cent, as compared with the number loaded in 1935, an increase of 5,217,347 cars, or 1.69 per cent, above 1934 and 6,843,255 cars, or 23.4 per cent, above 1933. It also represented an increase of 7,883,355 cars, or 28 per cent, above 1932, but a reduction of 1,087,942 cars, or 2.9 per cent under 1931.

Davis Lauds Railways' Record

Citing the railroad industry as " a notable example of the efficiency of private enterprise," J. M. Davis, president of the Delaware, Lackawanna & Western, asserted in an address on January 14, that "the most stabilizing support received by the government during the depression came from industries which to the limit of their ability 'kept going' in the face of obstacles, many of which originated with government itself." Asserting that the carriers have "raised their standards of efficiency to a degree never before achieved," the speaker proceeded to cite instances wherein they have at the same time promoted business recovery. They have, he said in this connection, "Borne the sole cost of the innovations introduced into their transportation services while on the other hand newer agencies have received the benefits of governmental assistance."

Mr. Davis also pointed out how the railroads have been criticized "for doing too much and for doing too little;" have been accused "of retarding progress while in the same breath they have been accused of undue favoritism towards industries and towards localities." He contended in these connections, that "had it not been for the contribution made by the railroads to the development of the country and to progress, we still would be buying buggy whips instead of drawing rooms as the accoutrements of travel."

Larger Appropriation Proposed for I.C.C.

An appropriation of $7,939,500 for the work of the Interstate Commerce Commission for the fiscal year 1938 is recommended in the budget transmitted to Congress by the President. This represents an apparent increase of $849,950 over the appropriations for the current fiscal year but, because unexpended balances amounting to $157,000 are to be reappropriated, the real increase is only $692,950. An increase of $750,000 is proposed for expansion in the enforcement of the motor carrier act and an increase of $40,000 is proposed for expansion of the air-mail contract work, while there is an offsetting decrease of $100,000 in the amount proposed for valuation work.

I.C.C. Hearings on Rate Increases

Hearings on proposals submitted by the railroads for a readjustment of freight rates, including both increases and decrease but, in general, designed to offset in part the loss of revenue from the emergency charges which expired on December 31, were commenced by the Interstate Commerce Commission at Washington, on January 6. While testimony presented so far at the hearings has been by railroad representatives in support of the proposals, it is expected that representatives of shippers will strenuously oppose the increases. In their testimony the railroads have sought to show that rate increases are needed in order to balance increased prices of materials which the railroads consume and to help pay for new equipment that will be needed to handle an expected increase in business.

A partial victory for the railroads in their attempt to secure higher rates was achieved recently when the commission allowed increases in transcontinental freight rates by declining to suspend them in spite of many protests from shippers. These increases closely approximate the emergency charges which expired by limitation on December 31. However, other increases proposed by the Western lines were suspended by the commission.

Expect Increase In Car Loading

Freight car loadings in the first quarter of 1937 are expected to be about 9 per cent above actual loadings in the same quarter in 1936, according to estimates compiled by the 13 Shippers' Regional Advisory Boards. With these estimates as a basis, car loadings of the 29 principal commodities will amount to approximately 5,307,000 cars in the first quarter of this year, as compared with actual loadings of 4,859,593 cars during the corresponding period of 1936. All of the regional advisory boards, except those for the Central Western and the Northwest regions, anticipate increases in loadings in their respective regions during the first quarter.

Railroad Legislation

As the first session of the seventy-fifth Congress opened on January 5, many bills involving legislation affecting the railroads were re-introduced in the form in which they had been presented in previous sessions and several new ones were expected. The bill to repeal the long-and-short-haul clause of the Interstate Commerce Act, which was passed by the House at the last session, but not by the Senate, was re-introduced by Representative Pettengill of Indiana. Other bills that were re-introduced include the full-crew and train-limit bills proposed by the railroad labor organizations, the signal inspection and train dispatching bills and the track inspection bill. Two other bills, one providing for government ownership of the carriers and the other for application of the six-hour day to the railroads, are expected to be introduced later in the session.

More Equipment and Maintenance Programs

Supplementing announcements published in the January issue a number of additional railroads have announced their intention of making substantial expenditures in 1937 for the purchase or construction of rolling stock and for maintenance of way. The Missouri-Kansas-Texas will spend approximately $5,000,000 for 1,279 freight and passenger cars and $10,000,000 for track and equipment maintenance, while the Baltimore & Ohio has authorized the purchase of 2,000 gondola cars and the construction of 2,000 covered wagon-top box cars at a total cost of approximately $10,000,000. In addition, application has been made to the Interstate Commerce Commission by the Chicago, Burlington & Quincy for authority to issue $7,080,000 of 2 per cent equipment trust certificates, proceeds from the sale of which are to be used in financing the construction of new equipment having a total estimated cost of $8,861,300. The Chicago & North Western has been authorized by the federal district court at Chicago to purchase $6,307,500 of new equipment.

Association News

Metropolitan Track Supervisors Club

The next meeting of the club will be held on February 11, at the Hotel McAlpin, New York, at 8 p.m., following dinner which will be served at 6:30 p.m. The meeting will be addressed by C. B. Bronson, inspecting engineer, New York Central, on the subject "Methods of Improving the Service of Rails."

Maintenance of Way Club of Chicago

Eighty members and guests attended the meeting held on January 18, when A. N. Reece, chief engineer, Kansas City Southern, presented a paper with the title, How Strong Should Track Be? In this paper, Mr. Reece presented conclusions based on the rail investigation conducted by his road several years ago and on the work of the Committee on Stresses in Track of the American Railway Engineering Association. His remarks were actively discussed from the floor.

The next meeting will be held on March 1, when the operation and upkeep of work equipment will be discussed.

National Railway Appliances Association

A total of 98 companies have now arranged to participate in the exhibit of roadway and signaling materials to be presented by the National Railway Appliances Association at Chicago on March 15-18. Supplementing the list published in the December issue of *Railway Engineering and Maintenance*, the following companies have arranged for space:

Achuff Railways Supply Co., St. Louis, Mo.
Ames Baldwin Wyoming Co., Parkersburg, W. Va.
Armstrong Paint & Varnish Co., Chicago
Barret-Christie Co., Chicago
Caterpillar Tractor Co., Peoria, Ill.
Dearborn Chemical Co., Chicago
Detroit Graphite Co., Detroit, Mich.
International Harvester Co., Chicago
Link Belt Co., Chicago
Lufkin Rule Co., Saginaw, Mich.
McKenna Process Company of Illinois, Joliet, Ill.
George P. Nichols & Bro., Chicago
Parker-Kalon Corp., New York
Power Ballaster Co., Chicago
Renchtite Spring Nut Co., Chicago
Schram, Inc., Philadelphia, Pa.
Snap-On Tools, Inc., Kenosha, Wis.
United States Gypsum Co., Chicago
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Woodings Verona Tool Works, Verona, Pa.
Woolery Machine Co., Minneapolis, Minn.

Wood Preservers Association

More than 100 railway officers were included among the 300 men who attended the thirty-third annual convention at New Orleans, La., on January 26-28, at which consideration was given primarily to the revision of specifications for the treatment of timber and the review of service records of timber treated. Papers were presented on "25 Years' Experience with Ties and Timber," by C. S. Kirkpatrick, chief engineer of the Missouri Pacific lines, and on the Southern railway's trestle across Lake Pontchartrain, by Prof. W. B. Gregory of Tulane university. The latter paper appears on a preceding page in this issue. R. S. Manley, president of the Texas Creosoting Company, Orange, Tex., presided over the meeting.

The following officers were elected for the ensuing year: President, H. R. Duncan, superintendent timber preservation, C. B. & Q., Galesburg, Ill.; first vice-president, B. M. Winegar, Canada Creosoting Co., Montreal, Que.; second vice-president, C. S. Burt, superintendent ties and treatment, I. C., Grenada, Miss.; members executive committee, Ralph E. Meyers, sales manager, International Creosoting & Construction Co., Galveston, Tex., and R. H. Colley, engineer, Bell Telephone Laboratories, New York City. H. L. Dawson, Washington, D.C., was re-elected treasurer. Chicago was selected as the 1938 convention city.

American Railway Engineering Association

Preparations for the convention which will be held at the Palmer House, Chicago, on March 16, 17 and 18 are rapidly taking final form.

The Committee on Arrangements held a meeting with President A. R. Wilson in the office of Secretary E. H. Fritch, on January 29, for the purpose of discussing plans for the most expeditious conduct of the convention in the face of an anticipated increase in the attendance. A program booklet, like the one issued for the first time last year, will be sent to the members late in February. In addition to the program, this will contain a synopsis of the committee reports, special references to the annual luncheon and N.R.A.A. exhibit, and other information of interest and value to those who are planning to attend the convention.

Among recent committee meetings were those of the Committee on Rules and Organization, at Chicago, on January 11, and of the Committee on Yards and Terminals, at New York, on January 19. The only meeting scheduled for February is that of the Committee on Iron and Steel Structures, which will meet at Urbana, Ill., on February 4 and 5. As in the past years a number of the committees are planning to hold breakfast or luncheon meetings during the course of the convention.

Bridge and Building Association

Plans are being prepared for the annual get-to-gether luncheon of the members who will be in Chicago during the A.R.E.A. convention in March. A meeting of the executive committee will be held at the same time.

The roster of the committees that have been appointed to present reports at the next convention has been completed and the personnel of these committees together with the subjects assigned to them are as folows:

Committee No. 1—Rebuilding our Bridge and Building Organization to Meet the Demands of the Present Day; Armstrong Chinn (chairman), chief engr., Alton, Chicago; F. E. Weise (vice-chairman), chief clerk engr. dept., C.M.St P. & P., Chicago; W. A. Batey, syst. bridge insp., U.P., Omaha, Neb.; R. W. Cook, gen. bridge insp., S.A.L., Norfolk, Va.; A. S. Krefting, asst. engr., St.P.M. & S.S.M., Minneapolis, Minn.; W. J. H. Manning, div. eng., D. & H., Plattsburg, N.Y.; B. R. Meyers, asst. engr., C. & N.W., Sioux City, Iowa; P. C. Newbegin, chief engr., B. & A., Houlton, Me.; T. W. Pinard, engr. b. & b., Penna., New York; A. A. Riley, supvr. struct., S.P., Houston, Tex.; G. L. Sitton, chief engr. m. of w. & s., Sou., Charlotte, N.C.

Committee No. 2—Recent Developments in the Construction of Timber Trestles: W. S. Lacher (chairman), managing editor, *Railway Engineering and Maintenance*, Chicago; E. E. R. Tratman (vice-chairman), const. engr., Wheaton, Ill.; Maxfield Bear, chief conc. insp., C. & N.W., Chicago; C. N. Billings, supvr. b. & b., S.P., Ennis, Tex.; M. A. Bost, asst. engr., C.M.St.P. & P., Mason City, Iowa; L. G. Byrd, supvr. b. & b., M.P., Poplar Bluff, Mo.; L. D. Garis, gen. bridge insp., C. & N.W., Chicago; W. G. Kemmerer, asst. engr., Penna., Chicago; W. F. Koehn, b. & b. mast., C.P.R., Montreal, Que.; C. L. Metzmaker, supvr. b. & b., C. & I.M., Springfield, Ill.; George W. Rear, bridge engr., S.P., San Francisco, Cal.; L. J. Tetreault, ast. foreman, b. & b., N.Y. N.H. & H., Worcester, Mass.

Committee No. 3—Practical Measures for the Protection of Bridges and Buildings Against Fire: H. I. Benjamin (chairman), insurance com., S.P., San Francisco, Cal.; F. W. Hillman (vice-chairman), asst. engr. maint., C. & N.W., Chicago; F. R. Allen, supvr. fire prev., P.M., Detroit, Mich.; F. G. Campbell, spl. engr., E.J. & E., Joliet, Ill.; V. E. Engman, chief carp., C.M.St.P. & P., Terre Haute, Ind.; C. S. Heritage, bridge engr., K.C.S., Kansas City, Mo.; H. G. Johnson, asst. engr., C.M.St.P. & P., Chicago; W. V. Kerns, asst. supvr. b. & b., C. & N.W., Chicago; A. L. McCloy, supvr. b. & b., P.M., Saginaw, Mich.; P. J. Matheson, asst. engr., C.N.R., Toronto, Ont.; H. E. Thompson, supr. b. & b., D. & H., Oneonta, N.Y.; T. B. Turnbull, supvr. b. & b., Ann Arbor, Owosso, Mich.

Committee No. 4—Taking Up the Deferred Maintenance in Painting: T. P. Soule (chairman), gen. supvr. b. & b., N.Y.C., New York; C. Miles Burpee (vice-chairman), research engr., D. & H., Albany, N.Y.; C. W. Boyce, supvr. b. & b., Y. & M. V., Vicksburg, Miss.; V. S. Brokaw, asst. engr., C.M.St.P. & P., Chicago; G. S. Crites, div. engr., B. & O., Punxsutawney, Pa.; H. Cunniff, gen. for., painters, D. & H., Cohoes, N.Y.; A. D. Gillis, supvr. b. & b., N.Y.N.H. & H., Providence, R.I.; C. E. Horrom, supvr. b. & b., Alton, Bloomington, Ill.; P. F. Maisenbacher, rdm., E.J. & E., Gary, Ind.; T. D. Saunders, asst. engr., C.N.R., Toronto, Ont.; B. M. Whitehouse, gen'l. bridge insp., C. & N.W., Chicago.

Committe No. 5—Meeting Today's Demands for Water Service: H. B. Christiansen (chairman), div. engr., C.M.St.P. & P., LaCrosse, Wis.; J. S. Hancock

(vice-chairman), bridge engr., D.T. & I., Dearborn, Mich.; R. C. Bardwell, supt. w.s., C. & O., Richmond, Va.; J. H. Bugg, supvr. w.s., C.N.R., London, Ont.; R. T. Burns, supvr. w.s., C. & N.W., Boone, Iowa; L. A. Cowsert, supvr. tests, B. & O., Dayton, Ohio; L. A. Davis, supvr. w.s., M.P., Osawatomie, Kan.; C. R. Knowles, supt. w.s., I.C., Chicago; J. H. McClure, b. & b. mast., C.N.R., Moncton, N.B.; J. W. Porter, prin. asst. engr., C.N.R., Winnipeg, Man.

Committee No. 6—The Maintenance of Movable Bridge Spans: J. L. Vogel (chairman), bridge engr., D.L. & W., Hoboken, N.J.; H. A. Gerst (vice-chairman), asst. bridge engr., G.N., Seattle, Wash.; A. E. Bechtelheimer, asst. bridge engr., C. & N.W., Chicago; W. R. Ganser, mast. carp., Penna., Camden, N.J.; R. W. Johnson, asst. engr., C.M.St.P. & P., Chicago; F. H. Masters, asst. chief engr., E.J.& E., Joliet, Ill.; C. A. J. Richards, mast. carp., Penna., Chicago; W. H. Norris, bridge engr., Me. Cent., Portland, Me.

Committee No. 7—Protecting Men Against Accidents in the Use of Power Tools: F. H. Cramer (chairman), asst. bridge engr., C.B. & Q., Chicago; G. E. Boyd (vice-chairman), associate editor, *Railway Engineering and Maintenance*, Chicago; R. E. Dove, asst. engr., C.M. St. P. & P., Chicago; C. R. Knowles, supvr. w.s., I.C., Chicago; W. J. Martindale, bridge for., T.H. & B., Hamilton, Ont.; E. Patenaude, b. & b., mast. C.P.R. Sudbury, Ont.; E. Pharand, supt. work equip., C.N.R., Toronto, Ont.; P. B. Ransome, supvr. b. & b., C. & N.W., Madison, Wis.; C. U. Smith, harbor commission, Milwaukee, Wis.; J. L. Varker, supvr. b. & b., D. & H., Carbondale, Pa.

Committee No. 8—The Insulation of Railway Buildings: E. L. Rankin (chairman), archt., G.C. & S.F., Galveston, Tex.; Maro Johnson (vice-chairman), prin. asst. engr., I.C., Chicago; J. E. Bird, ast. supvr. b. & b., N.Y.C., Corning, N.Y.; H. J. Crudge, bldg. engr., C.N.R., Moncton, N.B.; W. H. Harrison, b. & b., master, C.P.R., Toronto, Ont.; O. W. Stephens, supvr. b. & b., D. & H., Watervliet, N.Y.; T. H. Strate, div. engr., C.M.St.P. & P., Chicago; L. C. Winkelhaus, archt., C. & N.W., Chicago; C. W. Wright, mast. carp., L.I., Jamaica, N.Y.; G. E. Boyd, associate editor, *Railway Engineering and Maintenance*, Chicago.

Roadmasters Association

Following action taken at the meeting of the executive committee late in December, four of the committees appointed to prepare reports for presentation at the next convention have been assigned the subjects which they are to study. The subjects and committee personnel are as follows. The makeup of the fifth committee will be announced later.

Committee No. 1—Maintenance of Rail Joints: G. L. Sitton (chairman), chief engr. m.w. & s., Sou., Charlotte, N.C.; F. B. LaFleur (vice-chairman), rdm., S. P., Lafayette, La.; G. E. Boyd, associate editor, *Railway Engineering and Maintenance*, Chicago; Armstrong Chinn, ch. engr., Alton, Chicago; W. Constance, supvr. recl., C. & O., Batboursville, W. Va.; R. W. Grigg, supvr. Penna., Orrville, Ohio; M. Donahoe, div. engr., Alton, Bloomington, Ill.; G. W. Hammonds, rdm., M.P., Kinder, La.; J. B. Kelly, gen. rdm., M. St. P. & S.S.M., Minneapolis, Minn.; H. P. Mason, supvr., B. & M., Boston, Mass.; O. R. McIlhenny, rdm., Tenn. Coal, Iron & R.R., Birmingham, Ala.; P. F. Muller, rdm., C. & W. I., Chicago; D. V. O'Connell, rdm., C. & N. W., Chicago; I. D. Talmadge, rdm., N.Y.O. & W., Middletown, N.Y.; A. H. Wehner, rdm., S.P., Lake Charles, La.; W. H. Haggerity, supvr., N.Y.N.H. & H., New Rochelle, N.Y.

Committee No. 2—Housing of Track Labor: J. A. Turner (chairman), rdm., A.C.L., Sanford, Fla.; N. D. Howard (vice-chairman), eastern editor, *Railway Engineering and Maintenance*, New York; W. M. Anderson, rdm., S.A.L., Birmingham, Ala.; E. L. Banion, rdm., A.T. & S.F., Independence, Kan.; C. C. Clark, rdm., S.P., Ogden, Utah; M. H. Dick, associate editor, *Railway Engineering and Maintenance*, Chicago; L. J. Drumeller, div. engr., C. & O., Hinton, W. Va.; H. E. Kirby, asst. engr., C. & O., Richmond, Va.; C. A. Lichty, C. & N. W., Chicago; E. F. Manson, div. engr., C.R.I. & P., Fairbury, Neb.; E. L. Potarf, dist. engr., m. of w., C.B. & Q., Omaha, Neb.

Committee No. 3—The Trackman's Responsibility for the Safety of Highway Crossings: E. J. Brown (chairman), rdm., C.B. & Q., Chicago; F. J. Meyer (vice-chairman), asst. engr., N.Y.O. & W., Middletown, N.Y.; F. C. Chandler, rdm., A.C.L., Tampa, Fla.; F. L. Etchison, rdm., A.C.L., Charleston, S.C.; A. F. Kadow, div. engr., Alton, Bloomington, Ill.; F. J. Liston, rdm., C.P.R., Montreal, Que.; F. H. Masters, ast. ch. engr., E.J. & E., Joliet, Ill; R. E. Meyer, rdm., C. & N.W., Wall Lake, Iowa; J. W. Morgan, supvr., C. of Ga., Leeds, Ala.; G. P. Palmer, engr. maint., B. & O.C.T., Chicago; S. W. Payson, rdm., St.L.S.W., Enid, Okla.; N. E. Peterson, rdm., C. & I.M., Springfield, Ill.; A. L. Pollock, rdm., A.T. & S.F., Oceanside, Cal.; F. W. Tomlinson, asst. supvr., Penna., Trenton, N.J.

Committee No. 5—Good Practice in the Laying of Rail to Secure Workmanlike Results: L. E. Thornton (chairman), asst. engr., Alton, Bloomington, Ill.; J. J. Clutz (vice-chairman), supvr., Penna., Trenton, N.J.; F. G. Campbell, spl. engr., E.J. & E., Joliet, Ill.; P. Chicoine, rdm., C.P.R., Vaudreuil, Que.; E. L. Farmer, rdm., St. L.S.W., Lewisville, Ark.; Wm. Hogan, supvr., B. & O.C.T., Chicago; P. Immroth, rdm., A.T. & S.F., Syracuse, Kan.; C. J. Jaeschke, div. engr., M.P., Poplar Bluff, Mo.; P. L. Koehler, asst. engr., C. & O., Russell, Ky.; W. S. Lacher, managing editor, *Railway Engineering and Maintenance*, Chicago; J. H. Lynch, rdm., C.R.I. & P., Chickasaw, Okla.; F. L. McMillan, supvr., Alton, Joliet, Ill.; C. T. Mulcahy, rdm., S.P., Niland, Cal.; G. M. O'Rourke, dist. engr., I.C., Chicago; A. H. Peterson, rdm., C.M.St.P. & P., Chicago; E. P. Safford, supvr., N.Y.C., Silver Creek, N.Y.; R. L. Sims, dist. engr., m. of w., C.B. & Q., Galesburg, Ill.; O. Surprenant, rdm., D. & H., Schenectady, N.Y.; E. A. White, rdm., C. & N.W., Wall Lake, Iowa.

Personal Mention

General

G. A. Williams, supervisor of track on the Philadelphia Terminal division of the Pennsylvania, with headquarters at Philarelphia, Pa., has been appointed supervisor, special duty, in the traffic department.

C. D. Merrill, division engineer on special duty in the office of the chief engineer of the Pennsylvania at Philadelphia, Pa., has been promoted to superintendent of the Wilkes-Barre division, with headquarters at Sunbury, Pa.

E. O. Hemenway, who has been connected with the engineering department of the Atchison, Topeka & Santa Fe for about 22 years, has been appointed land commissioner of that company with headquarters at Albuquerque, N.M.

John A. Gillies, superintendent of the Colorado division of the Atchison, Topeka & Santa Fe, and formerly a district engineer on this road, has been appointed assistant general manager of the Northern district of the Western lines with

John A. Gillies

headquarters at La Junta, Colo. Mr. Gillies was born on August 15, 1889, at Winnipeg, Man., and entered railway service on June 15, 1906, as a chainman on the Santa Fe. For the following nine years he advanced successively through various positions in the engineering department, including those of rodman and transitman, and on May 1, 1915, he was further promoted to district engineer of the Southern district, with headquarters at Amarillo, Tex. Subsequently he was transferred to the Northern district, with headquarters at La Junta, and on October 1, 1918, he was appointed trainmaster on the Western division at Dodge City, Kan. On May 15, 1923, Mr. Gillies was further promoted to assistant superintendent of the Western division, with the same headquarters, being advanced to superintendent of the Slaton division on November 15, 1928. Four years later he was transferred to the Colorado division, with headquarters at Pueblo, Colo., where he was

located at the time of his recent appointment as assistant general manager with headquarters at La Junta.

Engineering

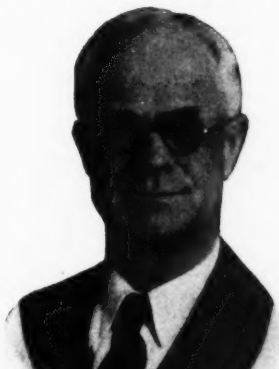
E. F. Kidder, roadmaster on the Union Pacific with headquarters at Walla Walla, Wash., has been promoted to division engineer of the Washington division, with headquarters at Spokane, Wash.

John W. Wheeler, a member of the Highway Commission of the State of Indiana, has been appointed to the newly-created position of engineer highway negotiations of the Chicago, Burlington & Quincy, with headquarters at Chicago.

Raymond Swenk, general superintendent of the eastern Pennsylvania division of the Pennsylvania with headquarters at Harrisburg, Pa., has been promoted to chief engineer maintenance of way of the Central region, at Pittsburgh, Pa.

J. L. Willcox, assistant engineer of statistics of the Atlantic Coast Line, with headquarters at Wilmington, N. C., has been appointed engineer of statistics, succeeding **L. L. Sparrow,** whose death on November 25 was noted in the January issue of *Railway Engineering and Maintenance*. Mr. Wilcox was born at Darlington, S. C., and was graduated from Wofford College in 1912. He entered the service of the Atlantic Coast Line in September, 1912, and has held various positions in the construction, valuation and maintenance of way departments, and in the chief engineer's office. He was appointed assistant engineer of statistics in 1929.

Frank T. Darrow, assistant chief engineer of the Chicago, Burlington & Quincy, Lines West of the Missouri river, with headquarters at Lincoln, Neb., has been promoted to chief engineer, effective February 1, with headquarters at Chicago, to succeed **Albert W. Newton,** who retired under the pension rules of the company on that date. Mr. Newton will continue in the service of the company with the title of consulting engineer. **H. A. Aalberg,** division engineer at Denver, Colo., has been appointed assistant chief engineer at Lincoln to succeed Mr. Darrow.



Frank T. Darrow

Mr. Darrow has been in the service of the Burlington for about 40 years. He was born on September 2, 1875, at Corning, Iowa, and received his higher education at Allegheny college, Meadeville, Pa., graduating with a degree in civil engineering in 1897. Before his graduation from college, Mr. Darrow was connected for several years with the Standard Box Factory, Portland, Ore., and also served with the Erie for three years at Corry, Pa. In 1897, he entered the service of the Burlington & Missouri River (now the C.B. & Q.), where he was engaged on location, construction, maintenance and bridge work until 1905, when he was appointed engineer maintenance of way of the Nebraska district. In 1907, Mr. Darrow was advanced to principal assistant engineer of the Lines West of the Missouri river, with headquarters at Lincoln, Neb. In 1909, after serving for a short time as assistant engineer maintenance of way at Lincoln, Mr. Darrow was advanced to engineer maintenance of way with the same headquarters. In 1918, he was appointed assistant chief engineer of the Lines West of the Missouri river, which position he held until his recent appointment as chief engineer at Chicago.

Albert W. Newton

Mr. Newton's service with the Burlington extended over a period of nearly 34 years. A native of Jerseyville, Ill., he engaged in general engineering practice from 1892 to 1898, then becoming engineer of the Sny Island Levee and Drainage district at Pittsfield, Ill. He entered railway service with the Chicago & Alton (now the Alton) in September, 1900, as assistant engineer at Kansas City, Mo., later being transferred to Bloomington, Ill. In March, 1903, Mr. Newton left the service of the Alton to go with the Burlington as construction engineer at St. Louis, Mo., being appointed assistant engineer with headquarters at Chicago, in October, 1904. In December of the same year, he was appointed engineer of the Missouri district at St. Louis, Mo., holding this position until January, 1907, when he was appointed general inspector of permanent way and structures in the office of the vice-president at Chicago. From January, 1915, to January, 1917, Mr. Newton held the position of assistant to the president of the Burlington, then being promoted to chief engineer, with headquarters at Chicago.

W. R. Gillam, division engineer of the Iowa division of the Illinois Central at Waterloo, Iowa, has been promoted to district engineer of the Southern lines, with headquarters at New Orleans, La., to succeed **M. B. Morgan,** deceased. **H Rhoads,** assistant engineer at Waterloo, has been promoted to division engineer

H. Rhoads

with the same headquarters, to succeed Mr. Gillam. **J. E. Fanning,** supervisor at Waterloo, has been appointed assistant engineer at that point, to replace Mr. Rhoads.

Mr. Rhoads has been identified with the Illinois Central for nearly 33 years. He was born on May 11, 1881, at Delaware, Ohio, and is a graduate (1902) of Purdue university. He first entered railway service with the Baltimore & Ohio Southwestern (now part of the Baltimore & Ohio), and later served with the Cleveland, Cincinnati, Chicago & St. Louis at Louisville, Ky., and Mattoon, Ill. He entered the service of the Illinois Central in June, 1904, as a track apprentice at Memphis, Tenn. Advancing through various positions in the engineering department, he was appointed division engineer at Dubuque, Iowa, in July, 1920. When this division was abolished in October, 1931, he was appointed assistant engineer at Waterloo, Iowa, which position he was holding at the time of his recent appointment as division engineer at Waterloo, effective January 1.

C. S. Weatherill, division engineer of the Eastern division of the Minneapolis & St. Louis, with headquarters at Oskaloosa, Iowa, has been promoted to the newly-created position of engineer maintenance of way, reporting directly to the general manager, with headquarters at Minneapolis, Minn. Mr. Weatherill's appointment became effective January 16. A brief biographical sketch of Mr. Weatherill was presented in the December, 1936, issue on the occasion of his appointment as division engineer.

Effective January 1 the Illinois and Iowa divisions of the Chicago Great Western, which were consolidated during the depression, were re-established as separate divisions. **H. E. Gardner,** who had been acting division engineer of both di-

visions with headquarters at Oelwein, Iowa, was appointed division engineer of the Illinois division with the same headquarters. **F. J. Hoffman, until** recently division engineer at Oelwein, has been appointed division engineer of the Iowa division, with headquarters at Des Moines, Iowa. **F. U. Mayhew** has been appointed engineer of surveys with headquarters at Chicago, a position that was held by Mr. Gardner prior to his appointment as acting division engineer.

Albert A. Colvin, whose appointment as engineer and supervisor of bridges and buildings on the Chicago & North Western at Mason City, Iowa, was reported in the January issue, was born on September 20, 1887, at Wheaton, Ill. Mr. Colvin studied civil engineering at the University of Illinois and entered railway service in 1910 with the Pittsburgh, Cincinnati, Chicago & St. Louis (now part of the Pennsylvania), being engaged on track elevation work at Chicago. In January, 1911, he left this company to go with the Chicago & North Western, where he served in the general manager's office until April, 1912, when he was assigned to track elevation work, with the title of assistant engineer. During a part of 1918, Mr. Colvin obtained a leave of absence and entered the employ of the government as a civilian member of the commanding officer's staff at the Scituate proving ground, Scituate, Mass., during the construction of that project. Since 1930, he has served as assistant supervisor of bridges and buildings, assistant roadmaster and assistant engineer at various points. At the time of his recent appointment as engineer and supervisor of bridges and buildings he was serving as assistant engineer at Sioux City, Iowa.

Curtiss E. Crippen, who had been appointed division engineer of the Dubuque and Illinois division of the Chicago, Milwaukee, St. Paul & Pacific, as reported in the December issue, has been identified with this company for about 10 years. He was born on December 20, 1907, at Austin, Minn., and received his higher education at the University of Minnesota, graduating in 1930. Mr. Crippen first served with the Milwaukee during the summer and winter of 1927-1928, as a rodman on maintenance work. During the following summer he served as a rodman on construction with the Minneapolis, St. Paul & Sault Ste. Marie, and during the summer of 1929, he was with this company as a rodman on maintenance. After his graduation from college in the spring of 1930, Mr. Crippen entered the service of the Milwaukee as an instrumentman on maintenance in the Twin City terminals, and in the following year he was transferred to the Iowa and Southern Minnesota division, with headquarters at Austin, Minn. In 1932 Mr. Crippen was transferred to the Dubuque and Illinois and Kansas City divisions, with headquarters at Savanna, Ill., and in 1933 he was sent to Chicago as a special inspector of locomotive water supplies for the system. He was holding this position at the time of his recent appointment as division engineer of the Dubuque and Illinois division.

Track

C. A. Williams, acting roadmaster on the Atchison, Topeka & Santa Fe at Carlsbad, N.M., has been appointed roadmaster with the same headquarters. Mr. Williams' territory includes the Roswell and Carlsbad districts of the Pecos division.

H. Gilyard, an extra gang foreman on the Chicago, Milwaukee, St. Paul & Pacific with headquarters as Andover, S. D., has been promoted to roadmaster with headquarters at Mobridge, S. D., to succeed **O. Haanes,** who has been transferred to Lewistown, Mont., to replace **C. R. Strong,** transferred.

Henry E. Michaels, assistant supervisor on the Panhandle division of the Pennsylvania, has been promoted to track supervisor on the Grand Rapids division, with headquarters at Kalamazoo, Mich., to succeed **H. B. Russell,** who has been transferred to Sub-Division B of the Logansport division at Logansport, Ind. Mr. Russell succeeds **Gustave Evert,** who has been transfered to Sub-Division C, with the same headquarters, to replace **J. H. Britton,** who has been disabled.

Mr. Michael was born on October 25, 1907, in Virginia and received his higher education at Lehigh university, graduating in 1930 with the degree of bachelor of science in civil engineering. He first entered the service of the Pennsylvania on June 14, 1926, as a trackman, in which capacity he was engaged on survey work in connection with additional yard facilities at Sandusky, Ohio. From July 15, 1927, to September 15 of the same year, Mr. Michael served as a rodman on the Lehigh Valley. During the next five years, while attending school and for some time thereafter, he served intermittently as an asistant on the engineer corps of the Panhandle division of the Pennsylvania, as an inspector on electrification work and as a trackman. On August 8, 1933, he was assigned to the office of the chief engineer maintenance of way at Pittsburgh, Pa., as an assistant on the engineer corps, being promoted to assistant supervisor of track at Steubenville, Ohio, on April 1, 1934. He was holding the latter position at the time of his recent promotion to supervisor of track at Kalamazoo, effective January 1.

Henry Ferryman, district roadmaster on the Butte division of the Great Northern, with headquarters at Havre, Mont., has been promoted to division roadmaster on the same division, with headquarters at Great Falls, Mont., where he replaces **A. Mitguard,** who has been transfered to Spokane, Wash., to succeed **T. Riley,** who has retired. **Francis Anderson** has been appointed district roadmaster at Havre, to replace Mr. Ferryman.

Mr. Ferryman has been in the service of the Great Northern for more than 12 years. He was born on February 24, 1900, at Wenatchee, Wash., and received his higher education at the Purdue University, graduating in 1924, with the degree of bachelor of science in mechanical engineering. Mr. Ferryman entered the service of the Great Northern on August 1, 1924, as assistant to the roadmasters on the Spokane division, later serving in the same capacity on various other divisions. In July, 1929, he was advanced to district roadmaster on the Kalispell division, with headquarters at Walton, Mont., being transferred to the Cascade division with headquarters at Everett, Wash., in 1931. Later in the same year he was transferred to Bend, Ore., where he was engaged on new line construction. In October, 1932, he was appointed district roadmaster at Conrad, Mont., and in December, 1934, he was transferred to Havre, Mont., where he was located at the time of his recent promotion to division roadmaster of the Butte division.

Robert R. Morman, whose appointment as supervisor of track on the Baltimore & Ohio at Indianapolis, Ind., was announced in the December issue, was born on September 7, 1906, at Ottawa, Ohio. Mr. Morman's first railway service was with the Baltimore & Ohio during the summer of 1919, when he acted as a water boy. During the two following summers he held a similar position on the Wabash and in October, 1921, he became a section laborer on the latter road. In April, 1922, he left railway service to enter an automobile factory, returning to railroad work in July, 1923, in the car shops of the Lake Erie & Western at Lima, Ohio. From March to December, 1924, he served as an assistant foreman on the New York, Chicago & St. Louis, then becoming engaged in work at Cleveland, Ohio. From March, 1925, to July, 1926, he worked in various automobile plants, then returning to the Baltimore & Ohio as an assistant track foreman, serving in this capacity and as a temporary track foreman until February 15, 1927, when he was advanced to extra gang foreman. From June 1, 1935, until his recent appointment as supervisor Mr. Morman served as general track foreman.

James F. Nellis, whose appointment as engineer supervisor on the Wabash at St. Louis, Mo., was reported in the January issue, was born on January 17, 1904, at Detroit, Mich., and is a graduate in civil engineering of the University of Detroit. Mr. Nellis first entered the service of the Wabash on April 1, 1929, as a track laborer and during the following three years he served in this capacity and as a rodman, bridge carpenter, transitman, field draftsman, assistant foreman, assistant foreman, assistant engineer, instrumentman, bridge inspector and ballast inspector. On October 1, 1933, Mr. Nellis left the railroad to go with the Northern Indiana Sand & Gravel Company on gravel pit construction at Wolcottville, Ind., leaving this company on March 31, 1934, to enter the service of the Indiana State Highway department as project engineer at East Chicago, Ind. He returned to the Wabash on December 20, 1934, as a bridge inspector at St. Louis, later serving as an instrumentman at St. Charles, Mo. On December 10, 1935, Mr. Nellis was promoted to resident engineer at Peru, Ind., being transferred to Ft. Wayne, Ind., on July 21, 1936, where he was located at the time of his promotion to engineer supervisor at St. Louis.

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Obituary

R. C. Pearson, division engineer on the Chicago, Burlington & Quincy with headquarters at Alliance, Neb., died at that point on January 13 of pneumonia.

Edward H. Lee, retired president of the Chicago & Western Indiana and formerly chief engineer of that company, died on January 11 of a heart attack which followed a brief illness with influenza.

James Parks, who retired on January 1, 1911, as a bridge and building supervisor on the Union Pacific, died at his home at Denver, Colo., on January 18, at the age of 94 years. A native of County Cork, Ireland, Mr. Parks came to the United States at an early age, entering the service of the Union Pacific on February 1, 1868, as a bridge carpenter at Cheyenne, Wyo. Subsequently he was advanced to carpenter, thence to bridge foreman and finally to supervisor of bridges and buildings, in which capacity he served for 32 years on the colorado division before retiring in 1911.

M. B. Morgan, district engineer of the Southern lines of the Illinois Central and of the Yazoo & Mississippi Valley (part of the I.C.), whose death on December 26 was reported in the January issue of *Railway Engineering and Maintenance*, was born at Nontecoka, Pa., in 1872. After ob-

M. B. Morgan

taining a degree in civil engineering at Pennsylvania State College, Mr. Morgan entered railway service with the Illinois Central in August, 1898, as a track apprentice at Chicago. During the following two years he served in this position and as a rodman and instrumentman at various points on the Northern lines, then, in April, 1900, being sent to Granada, Miss., as resident engineer on the construction of a line between Granada and Parsons, Miss. Later Mr. Morgan served in similar capacities at various locations on the Y. & M. V. and the southern lines of the Illinois Central until May, 1911, when he was appointed track supervisor on the Mississippi division. In May, 1912, he was advanced to division engineer of the Tennessee division, with headquarters at Fulton, Ky., and in November, 1913, he was sent to Chicago as assistant engineer maintenance of way. On July 17, 1916, he wa appointed district engineer of the Y. & M. V., and in 1931 his jurisdiction was extended to include also the Southern lines of the Illinois Central.

Charles Hansel, who for many years was connected with railway engineering and valuation work, died on December 24 at his winter home in Punta Gorda, Fla., at the age of 77 years. Mr. Hansel, who was born on July 31, 1859, at Peoria, Ill., was for four years locating and construction engineer for the Denver & Rio Grande (now Denver & Rio Grande Western) and was engineer in charge of the building of the first line of that road into New Mexico. From 1884 to 1889 he served as chief engineer of the Wabash, and subsequently became consulting engineer for the Railroad and Warehouse Commission of Illinois. From 1904 to 1906 he acted as consulting engineer for the Indiana Harbor Railway (now Indiana Harbor Belt), and on May 4, 1909, he was appointed a commissioner by the Governor of New Jersey to appraise the railroad and canal property in that state. In 1913 he became a member of the Engineering committee of the Presidents' Conference Committee on Valuation of Railroads, and in subsequent years he served as chairman of the Valuation committee of the Reading and the Central of New Jersey, and at one time acted as consulting valuation engineer for the Pennsylvania. Until recently, Mr. Hansel had taken an active part in the firm of Charles Hansel Construction Specialists.

Supply Trade News

General

The Northwest Magnesite Company has appointed **The Celotex Corporation,** Chicago, exclusive sales agent for Thermax structural insulation and Absorbex accoustical corrective. **R. E. Bennett,** of the Thermax Division of The Northwest Magnesite Company, is now connected with The Celotex Corporation.

The Stulz-Sickles Company, Newark, N.J., has opened a branch office in the 220 Dooly building, Salt Lake City, Utah, which will be in charge of **W. T. Jones.** This company has also opened a branch office at 3504 Rosedale street, Dallas, Tex., in charge of **Gil V. Dye.**

Personal

John H. Rodger, executive vice-president of the **Oxweld Railroad Service Company,** Chicago, has been elected president of that company. Mr. Rodger entered the railway supply business in New York in 1899 with the Standard Coupler Company. In 1911 he joined the Safety Car Heating & Lighting Company at Chicago, remaining with this organization 17 years and serving successively in the capacity of representative, western manager, and vice-president in charge of the Chicago district, and subsequently, vice-president at New York. In 1928, he resigned to become vice-president of the Oxweld Railroad Service Company, Chicago, and in

John H. Rodger

1930 was made executive vice-president, which position he held until his recent promotion.

Muscoe Burnett, Jr., assistant sales manager of **The Oxweld Railroad Service Company,** Chicago, has been promoted to sales manager, effective February 1. Mr. Burnett was born at Paducah, Ky., and was educated at the University of Virginia. Since leaving college in 1920, he has been associated continuously with various units of the Union Carbide & Carbon Corporation, of which The Oxweld Railroad Service Company is one. His first connection in 1920 was with The Oxweld Acetylene Company. Four years later he was transferred to the export department of the Union Carbide Company, later going to the Linde Air

Muscoe Burnett, Jr.

Products Company as assistant division manager at Chicago. He held the latter position until October, 1935, when he was appointed assistant sales manager of The Oxweld Railroad Service Company, which position he has held until his recent promotion.

R. H. White, Sr., president of the Southern Wood Preserving Company, died at Atlanta, Ga., on January 29, after an extended illness.

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SOUND TRACK

Ingersoll-Rand MT-3 Pneumatic Tie Tampers produce smoother and safer riding track, because these tools enable ballast to be compacted under the ties with much greater uniformity than is possible by hand methods.

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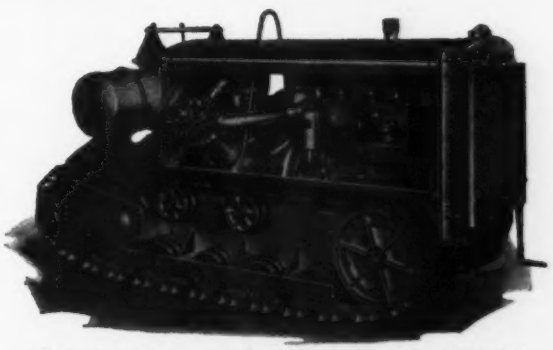

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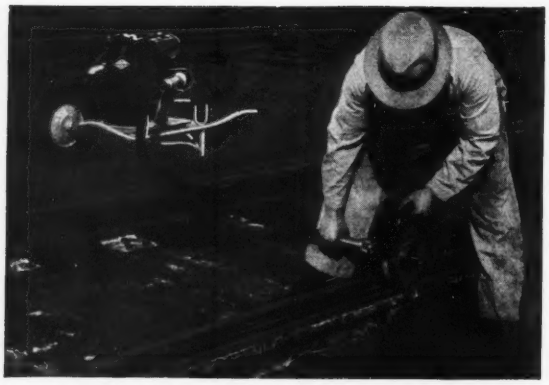

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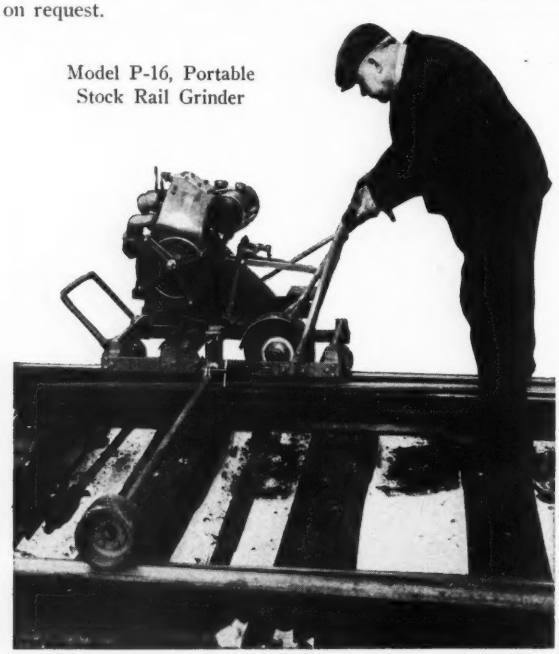

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A *New* REVERSIBLE RATCHET WRENCH

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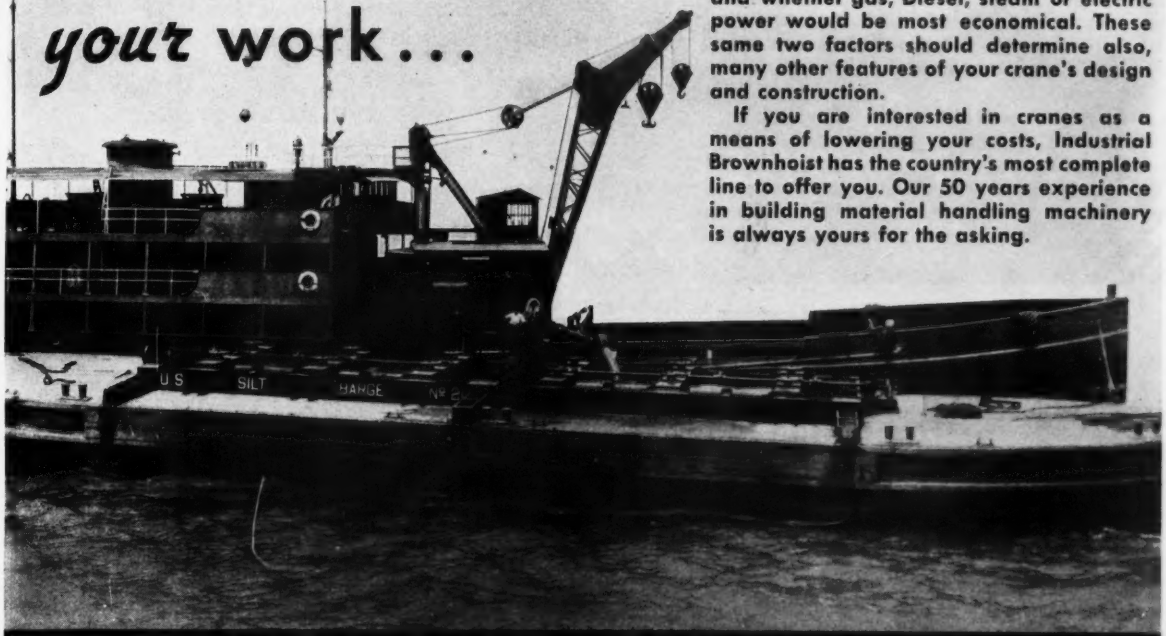
SUPERIOR DROP-FORGED TOOLS

Cranes...to suit your work...



Your operating conditions and the materials being handled should be the sole considerations in deciding whether you need a crawler, locomotive or fixed-base crane and whether gas, Diesel, steam or electric power would be most economical. These same two factors should determine also, many other features of your crane's design and construction.

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Moves *only* the tie to which the jack is applied . . . acts effectively with any make of track jack . . . quickly and easily placed in position on either rail for moving tie in either direction . . . easily released after removing jack.

Duff-Norton Genuine Barrett Track Jacks

The most widely used track jack in the railroad industry . . . incorporates the genuine Barrett improved mechanism . . . upper pawl has a spring attached which automatically forces it into position, leaving lower pawl free for tripping — a great safety factor.

Duff-Norton Special Jack for Pulling Drift Bolts

A valuable aid to many maintenance men . . . consists of a genuine Barrett lifting jack to which is added a special "Chain Top" with drift bolt pulling device. Device is available with or without jack . . . fits any standard lifting standard.

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A low height, single acting Track Jack for surfacing heavy rail and track . . . handles the heaviest rail section including 160 lb. type. Top fits under ball of rail on high ballast . . . groove permits pushing on bottom when ballast is low. Footlift is applied under the rail.

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"The House That Jacks Built"
RADIO PROGRAM
WEAF, New York; WMAQ, Chicago (6:45 p.m., C.S.T.); KDKA, Pittsburgh.

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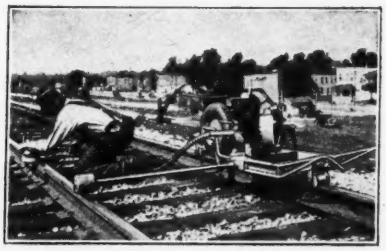
THE DUFF-NORTON MANUFACTURING COMPANY
PITTSBURGH, PA.

"THE HOUSE THAT JACKS BUILT"

Mall TRADE MARK

RAIL GRINDERS



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For Rail Surface, Frog, Crossing, and Switch Point Grinding, Drilling, and Lag Screw Driving.
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LOWERS COST

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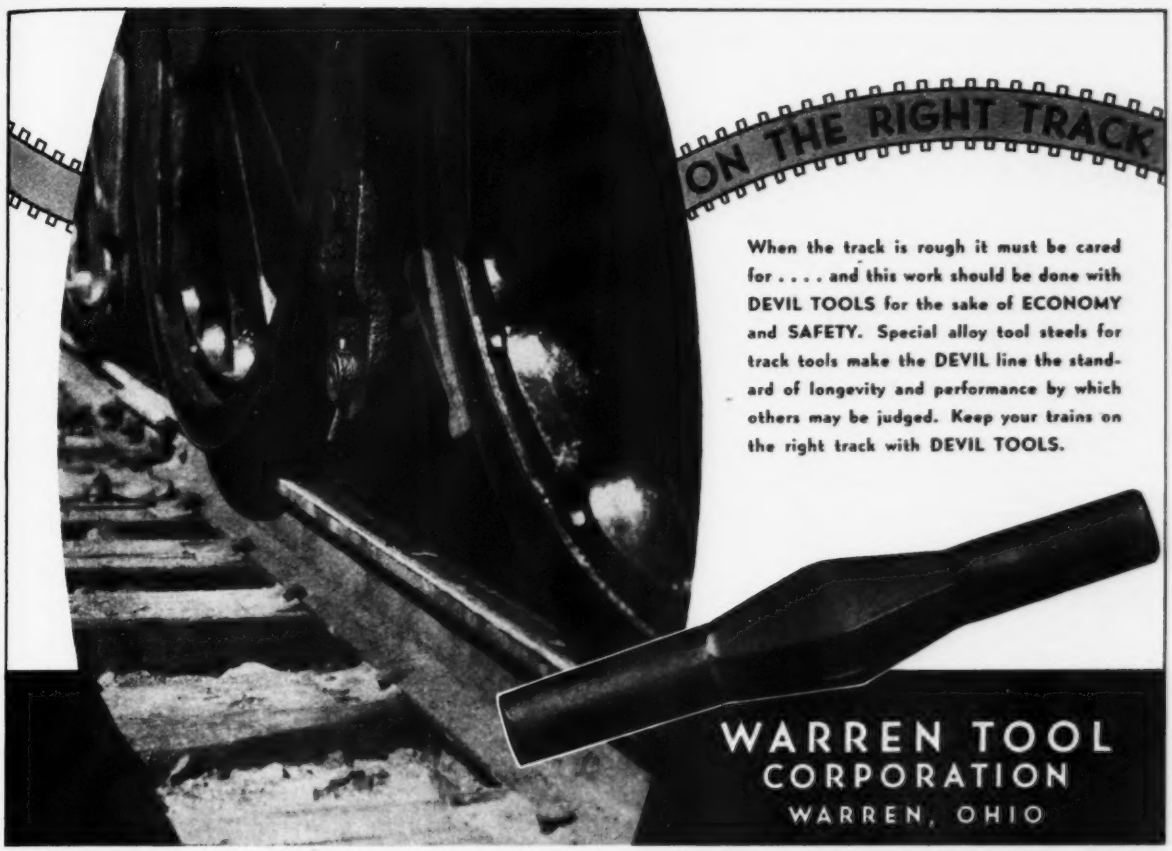

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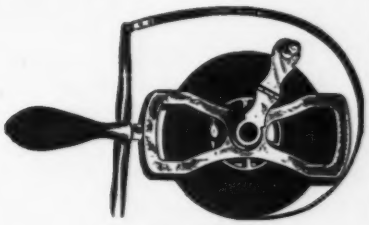

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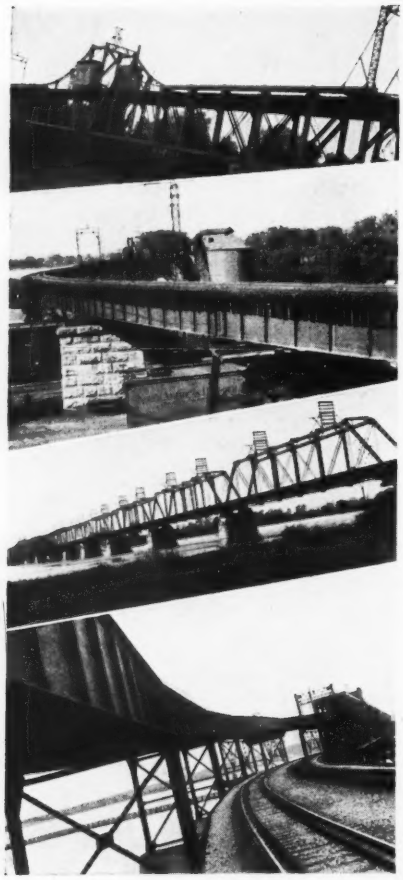

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NO-OX-ID
IRON-RUST
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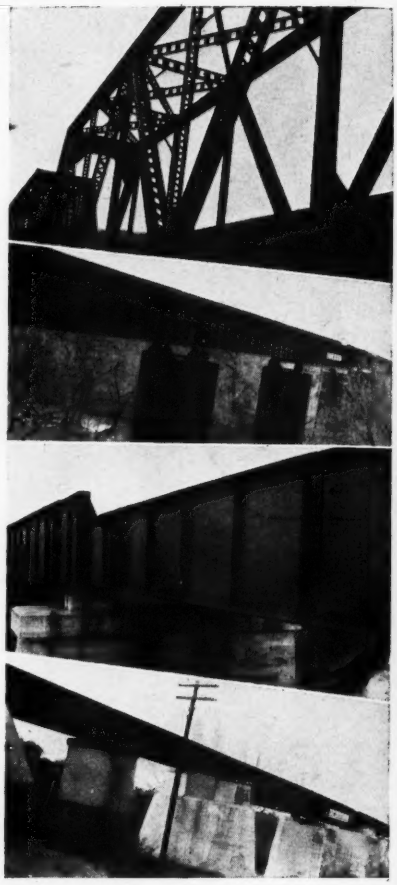

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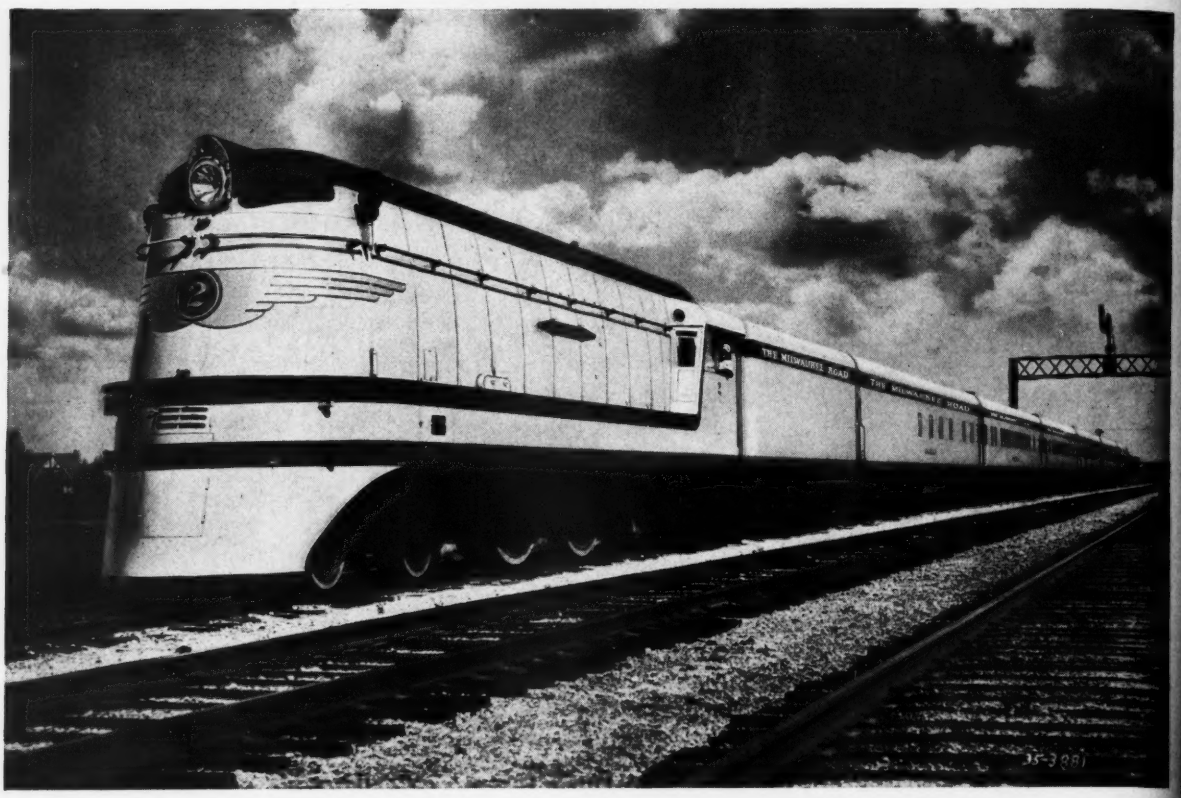

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